

RAILWAYS (INDIA).

RETURN to an Order of the Honourable The House of Commons,
dated 12 July 1853:—for,

COPIES or EXTRACTS “ of any CORRESPONDENCE received by the last Mail
from the Governor-General in Council in *India*, relative to RAILWAY
UNDERTAKINGS in that Country.”

East India House, }
18 July 1853. }

JAMES C. MELVILL.

(*Sir Herbert Maddock*)

Ordered, by The House of Commons, to be Printed,
19 July 1853.

COPIES or EXTRACTS of any CORRESPONDENCE received by the last Mail from the Governor-General in Council in *India*, relative to RAILWAY UNDERTAKINGS in that Country.

LETTER from the Governor-General of India in Council.

Home Department Railway, No. 4 of 1853.

To the Honourable the Court of Directors of the East India Company.

Honourable Sirs,

Fort William, 4 May 1853.

WE have the honour to acknowledge the receipt of your Honourable Court's several despatches as per margin,* and to transmit herewith our proceedings on the very important questions which your Honourable Court have referred for our opinion.

2. The consideration of these questions involved the necessity of previous reference to the several Presidencies, and the Governor-general having conferred personally with Major Baker, the consulting engineer to Government at this Presidency, and Major Pears, the consulting engineer to the Madras Government, who was summoned to Calcutta for the purpose; and having also, through the Government of Bombay, communicated with Captain Crawford, the consulting engineer at Bombay, who could not, owing to distance, be called to Calcutta, has embodied his views, and the conclusions to which he has arrived in the accompanying Minute, dated the 20th April, which we have now the honour to transmit, and with which the other members of Government have expressed their full concurrence.

3. The several questions treated in the Governor-general's Minute are as follows:

1st. The question of a general system of Railways for India, on which Major Kennedy has dwelt in the memorandum transmitted by your Honourable Court.

2d. The lines required in the Presidency of Bengal.

3d. The lines proposed and required in the Presidency of Bombay.

4th. The lines projected or desirable for the Presidency of Madras.

5th. The agency by which the lines shall severally be constructed.

6th. The general principles which ought to be observed in the construction of them; and,

7th. The particular companies which seek permission to undertake them.

4. The recommendations which we beg to offer to your Honourable Court, are as follows:

1st. That a general system of railways connecting the several Presidencies, and constituting the great trunk lines within them, should be sanctioned and executed without further delay.

2d. That the trunk line in the Presidency of Bengal should be carried up the valley of the Ganges to Allahabad, and thence up the Doab to Agra and Delhi, with a view to its being extended through the Punjab westward, as soon as its construction

* Financial, No. 51 of 1852, dated 22d September, with a memorandum by Major Kennedy, on the lines of Railway proposed at Bombay, and on the subject of Railways for India generally.

Financial (Railway), No. 1 of 1853, dated 19th January, with a Memorial from the Directors of a proposed Company for the construction of a Railway from Bombay to Agra, *via* Baroda.

Financial, No. 67 of 1852, dated 21st December, relative to the extension of the Railway from Calcutta to the North West Frontier, the proper portions to be constructed, and the most eligible mode of carrying them on.

Financial (Railway), No. 4 of 1853, dated 2d March, referring to Court's Despatch to Madras, No. 13 of 1852, dated 18th August, regarding the lines of Railway for that Presidency.

Financial (Railway), No. 3 of 1853, dated 16th February, suggesting construction of a Railway to connect Diamond Harbour with Calcutta, and the establishment of Docks at Diamond Harbour in connexion with the Railway.

construction may be found practicable, and that the line to Diamond Harbour should be rejected.

3d. That a junction line should be formed between the above-mentioned trunk line and the Presidency of Bombay, either by the valley of the Nerbudda, or by way of Baroda and Neemuch; but preferably by the latter in the first instance, if further examination should recommend it.

4th. That in Bombay the Malsej Ghaut line should be abandoned; that the Thull Ghat line should not be sanctioned as a great trunk line of communication between Bombay and other parts of India.

That a line to Candesh, and a line to Poonah, should both be undertaken.

That if one only can be chosen, the line to Candesh should be preferred.

That it should not be resolved to carry such line to Candesh up the Ghats, unless a survey of a line by the Taptee River should show the Ghat line to be less objectionable than the river line.

That if the Ghat line should prove the better, it should not be sanctioned as now proposed, by the Thull Ghat, unless further survey shall establish that no better access to the table-land can be found on the Syhadree range, and that the present objectionable features in the Thull Ghat line cannot be avoided.

Lastly. That the same rule should be applied to the line by the Bhore Ghaut.

5th. That a line should be formed in the Presidency of Madras by Menil (to which point it has been already sanctioned), Vellore, Vaniembaddy and Coimbatore, and thence to the western coast; with a branch to Bangalore, and a branch also to the foot of the hills towards Ootacamund.

That another line should be constructed in the Presidency of Madras from that city by Cuddapah to Bellary; and that surveys, &c. should be made with a view to its extension across the table-land to Poona, in the Presidency of Bombay, in order thereby to form a junction with the western coast.

6th. That the construction of these lines should be committed to incorporated railway companies under the control of the Government in the manner which has been agreed upon in the case of the East Indian Railway Company, and on such terms as may be fixed.

7th. That, if it be necessary to guarantee a certain interest on the capital of a company, means should be taken to ascertain approximately the probable amount required for the construction of the line, and the amount of requisite capital on which interest is to be guaranteed should be strictly defined; and that the completion of the line should be required within a certain fixed period, under the penalty of a diminution of a certain proportion of the guaranteed interest for every half-year in which the line shall remain incomplete after the expiry of the period fixed.

8th. That all lines for the present should be formed with a single track, with bridges, embankments, &c. for the same; land being in all cases taken, and the foundations of extensive work laid, to suit a double track.

9th. That the officers of the Honourable Company should be required to exact the utmost economy consistent with perfect security and efficiency in the original construction of the line, and in all buildings and works of every description connected with it.

10th. That no portion of a line should be opened for traffic until the capital account for that portion of the line shall have been closed in such manner as shall be to the satisfaction of the Government of India.

11th. That the line, when opened for the conveyance of passengers and goods, shall in like manner be managed with the closest attention to economy, in the working expenses rather than with a regard to the high rate of speed and frequency of despatch which are the practice on English lines.

12th. That the construction of lines to be managed upon the foregoing principles should be conceded to the East Indian Railway Company, from Calcutta to Allahabad, one uniform rate of interest being guaranteed upon the capital required for the whole line if a guarantee be indispensable.

13th. That the construction of the line from Allahabad to Delhi should be granted to the East Indian Railway Company on to the Upper India Company, but preferably to the former, if it will undertake the works on terms as favourable, or nearly as favourable, as those offered by the latter Company.

5. We submit these several recommendations to your Honourable Court, with the expression, in the words of the Governor-general, of our earnest hope that your Honourable Court "will resolve at once to engage in the introduction of a system of railways into this Indian Empire upon a scale commensurate with the magnitude of the interests that are involved, and with the vast and various benefits, political, commercial and social, which that great measure of public improvement would unquestionably produce."

We have, &c.
(signed *Dalhousie.*
F. Currie.
J. Lewis.

REPORT by the Consulting Engineer to Government Railway Department, on the Result of his Examination of certain Lines for the Extension of Railways in the Bengal Presidency, during the cold Season of 1852-53.

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Calcutta, 15 March 1853.

IN prosecution of the plan proposed in my memorandum, dated 25th October 1852, and approved by the Government, I proceeded to the examination of a direct line through the hills from Ranigunge to Patna, which had been proposed in a report addressed to Government by Professor Oldham. After following this line to the foot of Bhetia Ghat, and satisfying myself that it was not likely to answer, I proceeded due north to the nearest point on the Ganges (Soorajghurra), and thence in a westerly direction, examining the country on the right bank of that river to the termination of the hills between Mirzapoor and Allahabad. From this point I was returning, with the intention of completing my survey of the Ganges Valley Line from Soorajghurra, *via* Monghyr and Banghulpoor to Colong, when I received instructions to proceed with all expedition to Calcutta.

2. Throughout the greater part of this tour, I was accompanied by the chief engineer of the East Indian Railway, Mr. Turnbull, by whom instructions (the result of our joint examination of the country) were forwarded from time to time to the engineers employed on the trial sections between Rajmahal and Allahabad. I considered it important that Mr. Turnbull and I should reconnoitre the ground together, even at some sacrifice of mutual convenience: we were thus enabled to consider suggestions, and reconcile conflicting opinions on the spot, and within reach of the facts which alone could guide to a right decision, and I believe that we are, in fact, agreed upon all important points connected with the portion of the line which we examined together.

3. The surveys from Rajmahal to Allahabad have been completed, and the engineers are engaged in preparing maps and sections, and forming estimates, which will be forwarded with Mr. Turnbull's report, and will be accompanied by such further remarks from myself as they may appear to require.

4. In the meantime I beg to report the result of my personal observations, and first on the line recommended by Professor Oldham, who proposed to adopt
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the Ranigunge Colliery branch, as part of a trunk line to the North Western Provinces, and to extend it direct to Patna. The undulating character of the ground traversed by this branch, continues more or less through the hilly tract to the plains of Behar, and for 12 miles west of Ranigunge would involve ascending and descending gradient of about 1 in 300; from this point to Chukurdahar, about 60 miles, the country rises gradually, and would admit of a regularly ascending gradient, varying from 1 in 250 to 1 in 600. In this length the line would cross 11 nullas and streams, none of which are of much importance, and seven or eight hollows terraced for rice cultivation. These would provide for nearly all the drainage, as, with these exceptions, the line might be led, with very little deviation, from a straight course, along well-drained ridges, of which the drainage falls right and left into the Adjar and Burakur. Thus far a railway might be constructed with facility and economy, and would be liable to objection only on the score of gradients. From Chukurdahar, however, which is 1,150 feet above the sea, and the highest point on the line, the difficulties would commence; first, there is a descent of 330 feet into the valley of the Puttunjore, over seven miles of very rough country, intersected by ravines and covered with jungle, followed by a rise of 280 feet, and another fall of 200 feet to the Valley of the Adjai, from which there is a rise of 130 feet to the Chukai ridge.

5. The greater undulation above described might possibly be avoided by a line keeping closer to the Adjai: I believe that the valley of that river from near Elam Bazar would admit of the best line for a railway in this direction, should such ever be required; but the really obligatory point on the line is the lowest part of the Chukai Ridge, 1,030 feet above the sea, and 600 feet above the plain at the foot of the Bhattia Ghat.

6. Supposing, therefore, as I believe we may, that Chukai might be reached on an uninterruptedly ascending gradient, nowhere exceeding 1 in 250, it would still remain to get over a descent of about 600 feet through a rugged belt of rocks, seven or eight miles broad. The line by which the trial section was taken through the ghat was generally that of the cart-road, and appears to be the easiest passage that could be made without very expensive works; but even this would involve a gradient of 1 in 75 for six miles, with cuttings and fillings of 50 to 60 feet.

7. Of the three passages (the Bhattia, the Kuchiwa and the Beernur), examined by Mr. Turnbull and myself, the one which would admit of the best line without reference to cost, would be that of the Beerwar, a torrent which rises south-west from Chukai, and breaks through the hills in a broad winding channel. The fall is very rapid, especially at two points where the river forces its way through and over barriers of granite rock. A tolerably straight line might be obtained by tunnelling under some of the projecting rocks, and by crossing and recrossing the torrent five or six times on oblique viaducts. By these means, the gradient might be slightly improved, but only in proportion to the increase of distance.

8. The prospect of success on either of these lines did not appear to Mr. Turnbull or myself sufficient to warrant the detention of the engineers to take the sections of more than one of them, and for the same reason it was not considered necessary to level the line indicated by Professor Oldham from the Bhattia Ghat through Behar to Patna.

9. It appears to me, that the arguments adduced by Major Kennedy, and on which Government adopted the Ganges Valley line in preference to the direct one originally proposed by the East Indian Railway Company, are equally condemnatory of Mr. Oldham's route, which possesses all the advantages and disadvantages of the more direct line, but in a less degree.

10. For my own part, I should consider that neither the diminution of the direct distance between Calcutta and the North Western Provinces, nor the superior facilities and economy of construction claimed for this line by Mr. Oldham, would justify the adoption for the trunk line of railway of such gradient as are now shown to be inevitable on the Ranigunge and Patna direct route; but I believe that even these advantages have been greatly overrated by the supporters of the project. They may be resolved into two: 1st. Saving of

time and money in construction; 2d., saving of distance between the North Western Provinces and Calcutta.

11. The small number of river crossings between Ranigunge and Chuckee would be counterbalanced, partly at least, by the heavy embankments and rock cuttings; there would be a difficulty in organizing and maintaining working parties, which the country itself could neither supply nor feed. The long land-carriage of permanent way materials would be very expensive, and that of heavy iron-work or long balks of timber would be out of the question; whereas on the river line water-carriage would be everywhere available to within two or three miles of the works.

The descent through the Bhetia or Burnur Ghat, involving long tunnels through rock and lofty viaducts over valleys (the only possible material being stone, which must be quarried and shaped on the spot), would require an immense amount of labour and skilled supervision, and, even with these at command to an indefinite extent, would inevitably occupy many years; while the maintenance of large working parties in a country producing scarcely grain enough to support its scanty population, exceedingly unhealthy during several months in the year, and swarming with wild beasts, would of itself be no easy task. I will not attempt to estimate the cost of heavy works under the circumstances I have described, but it is evident that it would materially raise the average mileage rate of the whole line.

12. The admitted excess in length by 70 miles of the Ganges line has the countervailing advantage of tapping the fertile district north of the Ganges, and bringing into communication with each other and with the Presidency a greater number of populous towns and civil stations. For military objects, the directest route is, *ceteris paribus*, the best; but the amount of advantage is directly measured by the time lost in the deviation. A detour of 70 miles to troops marching 12 miles a day might not be justifiable; but where the distance can be got over in four hours, the objection nearly disappears.

13. Mr. Oldham describes the country traversed by his proposed line as one of rich produce and of great undeveloped mineral resources, for which the railway would provide an outlet; but to me the agricultural produce at least appeared limited to the supply of a scanty population. I doubt not that the improvement of this, as of any other country, would be stimulated by the introduction of a railway; but there are many provinces where this great engine of civilization would be better appreciated, while there are other and less costly means which would more immediately act on the prosperity of this. The construction of wells, where water is sufficiently near the surface, for purposes of irrigation, the formation of tanks, and the maintenance of a good cart-road (for both of which there are great natural facilities), might soon bring the country into a condition to invite railway enterprise.

14. I would hope that the results brought out by the examination of this route will obviate further discussion of direct lines through the hills to the North Western Provinces. The general features of this section resemble those of the line first proposed for the East Indian Railway, and are such as would characterize any other line with a similar object, viz., a gradual rise to the north-west, terminating in an abrupt descent into the Ganges valley. The crest, though undulating, has been described to me by Captain Sherwill, as continuous, and appears to be nowhere lower than at Chuckai, though it is probable that a descent more gradual than that of the Bhetia Ghat may be met with elsewhere.

15. A minor deviation from the proposed line by Rajmahal has been suggested by Mr. Turnbull, and has lately been examined: it would go nearly direct from Sooree (Beerbkoom) to Baughulpore, and would admit, I believe, of a ruling gradient of 1 in 300. My opinion is decidedly averse to the adoption of this line, which, on a small scale, has the same recommendations and objections which apply to the other more or less direct lines; and it may be said that the smaller the scale, the less excuse is there for introducing an exceptional gradient into the otherwise admirable profile of the line, which, I trust, will soon stretch from Calcutta to Lahore. The saving in distance would be about 30 miles, costing the sacrifice of Rajmahal, and of proximity to the river for 65 miles, within which the produce of Purnea, Rajeshye and Dinajpore would get access to the railway; the greater part of the More Valley line would lie through an unproductive

ductive and incapable country, and though the districts traversed by the other may not at present be better cultivated, they are, at least, susceptible of improvement.

16. I now proceed to describe the line most suitable for a railway from Soorujghurra, westward, passing over for the present the length between Soorujghurra and Colong, my personal inspection of which was prevented by the circumstances already adverted to. I would, in the first instance, call attention to the very remarkable disposition of the drainage, which enters the Ganges from the south, between Soorujghurra and Dinapoor, a disposition which resembles in character that described in a former report as obtaining in the Beerbhoom district, a mountainous tract of land, extending from Chuckai to Jupla (opposite Rotasghur on the Sone), through a length of 160 miles, and breadth varying from 60 to 100 miles, pours down its drainage in six principal streams (the Keul, Sukree, Punchuna, Fulgoo, Moorhur and Poon-poon), and innumerable minor watercourses. These all follow a general southerly direction, till they meet the raised margin of the Ganges, when they unite into a vast inundation, which has only two outlets into the Ganges, at Soorujghurra, through the Halahur, and at Patna, through the Poon-poon.

17. It is evident that the railway must pass on one side or other of this inundation; if to the southward, it must cross the drainage in detail, either close to the hills, where the ground is rough and undulating, and unfavourable to the maintenance of uniform gradients, or on the alluvial plain, where the rivers are capricious in their course, and their channels wide and sandy. In either case there would be no communication with the large towns studding the river bank, nor with the productive districts, or its northern border. If, on the other hand, it be possible to pass between the inundation and the Ganges, there need be but three considerable works in a distance of 60 miles, and the freest access will be obtained to the principal marts on the river.

18. I believe that this course is both possible and expedient, and that its advantages would far outweigh the objections which may be raised against it on account, first, of the difficulty and expense of dealing with such accumulated masses of water; and, secondly, of the risk to which the railway would be exposed from the encroachments of the river in close proximity to it for so many miles.

19. I would not underrate the difficulty of the works which, especially near Soorujghurra, would, indeed, be of great magnitude in proportion to the accumulated drainage which they have to pass, and to the varying height of water, which ranges to 30 feet between the rainy and dry seasons. It may further be assumed, that the soil at the site of these works will be found to consist of river silt to a great depth; but it must be considered, on the other hand, that the aggregate quantity of work on the three large bridges will be greatly less than would be required for numerous smaller, but still extensive works; and its concentration on a few spots would admit of the economical use of all the best modern appliances, and the closest supervision of selected engineers. The proximity of the river would be the best security against a strong current, or scour through the railway bridges, for the freshes invariably occur during the same season as the land inundations, which, in fact, they frequently dam back: it would also afford cheap water carriage for the heavy iron-work (which appears to me to be the material best suited to the purpose), and will thus obviate what would otherwise be the most serious difficulty, the provision of the requisite quantity of bricks in a locality where fuel of any kind is scarce and dear.

20. I believe that it would be quite possible to found a stable bridge of brick-work on the river silt at a proper depth; we have an example in the old native bridge at Fatwa, which carries the united waters of the Moorhur and Poon-poon through seven arches, having an aggregate waterway of 132 feet; but, for the reasons above stated, and in order to obstruct the channel as little as possible, I would prefer an iron structure for this purpose.

21. At first sight it appeared advisable to cross the Hurlahur at Soorujghurra, below the junction of the Keul Nuddee, and with this view Mr. Turnbull and myself carefully examined the locality. The high bank on which stands the village of Soorujghurra would be a good starting point; but the opposite or left bank

of the Hulahur, and, indeed, the strip of land lying between that river and the Ganges, as far as Burgoozur, is deeply inundated, and, consisting only of recent alluvium, is by no means safe from the encroachment of the Great River. There is, in fact, no good crossing of the Hulahur below its junction with the Keelul, and it will, therefore, be necessary to pass these streams separately, returning to the proximity of the Ganges near Barbeea, and following closely its right bank as far as the crossing of the Poon-poon at Futwa.

22. This line, for about 50 miles, would follow the northern edge of the land inundation, forming a border and barrier to the dry strip of ground above described, which is studded thickly with villages and mangoe groves, strongly contrasting with the treeless and houseless plain, stretching southward as far as the eye can reach—an inland sea in the rainy months, but green with wheat cultivation in the winter.

23. It may be objected, as suggested in paragraph 18, that a line following the river so closely, would not be safe from being undermined and carried away by its encroachment, and this objection, if well founded, would doubtless be fatal to the project: accordingly my most anxious attention was directed to this point, and I was enabled to satisfy myself, by personal inquiry, by the appearance of the bank, and by comparison of the ground with the revenue survey maps constructed in 1841-42, that the river is not generally encroaching on its right bank, and that that bank is protected by a stratum of strong red clay, mixed with kunker (a little above the cold-weather level of the river), which, not only has checked encroachments,* but would afford a firm basis for protective works, which at any particular point might possibly hereafter appear necessary. The railway would nowhere be nearer to the river than half a mile, which, under the circumstances I have described, appears to me a sufficient margin for security.

24. The crossing of the Poon-poon near Futwa would require a work similar to that over the Hulahur, and nearly as large. The native bridge already adverted to does not furnish a safe gauge of the waterway required. The great depth of the channel below the bridge seems to show a scour caused by insufficient vent; while for two or three miles westward of Futwa, on the Patna road, there are unmistakable marks of inundation crossing the country, and falling directly into the Ganges. These would require a separate provision of land arches.

25. The city of Patna occupies a narrow strip of high land, extending along the river bank, and bounded on the south by swamps and inundations. In approaching and passing this important emporium, the line must necessarily occupy much valuable land now covered with houses, gardens and religious buildings. The course proposed for the railway will take advantage of one of the ramparts of the Old Fort, running east and west about 3,000 yards in length, by which it will be brought into contact with the heart of the city, in the position which will least interfere with the principal thoroughfares. This rampart is the property of Government; but it is let on long leases, and is covered with huts and inferior houses. One or both of the other ramparts which run north and south might afford communication with the river bank by means of tramways; and at the junction of these with the railway, there would be sidings and wharf walls for the reception of goods. The principal passenger station and offices would be at Bankipoor (the civil station of Patna), from whence the line would proceed direct *via* Phoolvaree to the point fixed for the Sone crossing, or else by a more circuitous course *via* Dinapoor, should it be considered advisable to touch that cantonment. Both lines have been surveyed, and on both the intermediate ground is low, and liable to inundation from the Poon-poon and the Sone, to within a quarter of a mile of the latter river.

26. In compliance with the wishes of the Honourable Court of Directors, expressed in their despatch No. 45, of 1851, dated 20th August 1851, notifying their approval of the Ganges valley route as recommended by Major Kennedy, I proceed

* There is a slight exception at the town of Bar, where there is an appearance of one or two walls having fallen in at this place; however, the inhabitants have a custom of excavating and carrying away the red clay for the purpose of daubing their houses.

I proceed to describe more minutely the portion of the line between the Sone crossing and Mirzapoor.

27. The site which I believe was preferred by Major Kennedy for the passage of the Sone, near the village of Parewa, is that which to me also, on the whole, appears the most eligible. The river here flows in a well-defined channel, 4,000 feet in width. The banks on each side are above the highest flood-level, and consist of firm clay, calculated to afford a good foundation for works intended to resist the further encroachments of the river. I have not yet received a report on the borings made to ascertain the nature of the soil in the river bed, and on this will depend the description and cost of a structure suitable to the locality, and the expediency of constructing a bridge at once, or deferring it, as proposed by Major Kennedy, until the success of the line has been established. The former alternative would be obviously preferable, should it appear that the interest of the money to be spent on the bridge would not exceed the annual cost of the provisional arrangements, which must be made for the transit of goods and passengers.

28. It may be disputed whether a river like the Sone, which is in many places three miles broad, can safely be crossed at a point where its width is about one-fourth of that distance. I believe that it may, and that the narrow and deep channel, even with a less sectional area, may be dealt with more advantageously than the broad and shallow one. The Sone in its upper course has a strong fall, and is constantly cutting into one or other of its banks. It thus enlarges its apparent channel, without proportionately increasing its effective waterway; for much of the intermediate space is choked with sand-drifts; and though in extraordinary floods the whole channel may be superficially filled, it will be found that in many places the water is shallow, and in another it is nearly still. Again, in the upper part of the Sone, where the bed is wide, the river is liable to sudden freshes, which reach their height in a few hours, and after a short continuance rapidly decrease; but on its lower course the freshes rise more gradually, and continue longer. In the latter case the average discharge may be greater, and yet the channel may never be called upon to pass so much water at one time; still, however, it must be admitted as an objection of some weight, that the channel does not here carry the whole efflux of the Sone, part of which occasionally escapes over the left bank many miles higher up, and overflows the country.

29. The high ground on the left bank of the river opposite Purewa continues for about four miles, and is exempt from inundation as far as Kaimnuggur, from whence, for about 16 miles, we find the drainage of the country indefinitely augmented by the overflow of the Sone.

30. The Nugree Nuddee, which passes under Kaimnuggur, has been frequently bridged by the ferry-fund committee, whose labours have been as frequently overthrown by the floods. Its valley shows evident traces of the violent action of floods, and will require a great extent of arching.

31. The town of Arra is situated on a spot of high ground, intersected by a nulla, which is at present spanned by a bridge of 10 arches, seven of them having been added since the first construction of the bridge. The local drainage is inconsiderable; but during the Sone floods the water is said to fill the channel, and to rise occasionally to the level of the roadway. The line of railway will pass south of Arra, and sufficiently near the town to pick up the passenger traffic, which I expect will be considerable.

32. Westward of Arra, within a distance of 12 miles, the line will cross 10 watercourses of greater or less width, and all said to be within the influence of the Sone floods. Over all of these, bridges have been constructed by the ferry-fund committee, in many instances more than once, the broken structures being replaced by others of greater width. The aggregate waterway at present provided is 450 feet; but I suppose that double or three times that width would not be more than sufficient to provide against possible floods.

33. The soil in all the inundated lands consists chiefly of the black earth known by the local name of kurrial, which is said to be utterly unfit for the construction of embankments; I therefore examined with much interest, both

in dry and wet weather, the raised road between Arra and Buxar, which is in places formed of this soil; I found it, indeed, very soft after rain, and the road being unmetalled, was at that time very heavy for wheeled carriages; but I see no reason to fear that, with the aid of a good coat of ballast, it would not be sufficiently firm for railway purposes.

34. From the Gunga Nuddee, which is the last connected with the Sone to Buxar, a distance of 33 miles, the line would cross the Bhynswalee, the Kooa, the Bhynsa, and three other smaller channels, whose existing bridges appear to provide sufficiently for the waterway by an aggregate width of 287 feet.

35. Passing close behind the town and fort of Buxar, the railway will cross the Thora Nuddee, about 200 feet wide; and at a distance of seven miles from the fort will encounter the Kurrunnassa, a considerable river, flowing between high banks, with a width of 600 feet, and a difference of 35 feet between the flood level and that of the dry weather.

36. From the Kurrunnassa to the crossing of the great trunk road opposite Benares, a distance of 50 miles, the country is most favourable for the construction of a railway. The only appearance of flooding is caused by the local drainage, which runs off slowly, owing to the excessive flatness of the country: an embankment raised two or three feet above the natural surface, with a few culverts at long intervals, will constitute all the work required. Kunkur for ballast is found in abundance throughout the whole line.

37. It appears to me not advisable that the railway should pass nearer to the town of Benares than Mogulserai, which is about seven miles from Rajghat. By following the river more closely, it would encounter nullas, ravines and broken ground, besides a considerable increase of length. The traffic from the station to Rajghat would pass along the trunk road, unless it were found expedient to make a tramway.

38. Between Mogulserai and Chunar, a distance of 19 miles, the country becomes undulating, especially near the river bank, and is occasionally intersected by ravines; the railway would partly avoid these, by keeping well south of the river, but must cross several minor watercourses, besides the Jungo, a considerable stream, which passes under Chunar.

39. The sand-stone hills which skirt the Ganges at Chunar are broken up in the vicinity of that place into detached hills, between which the railway will pass without any serious cuttings or awkward detour; but the country on which it will enter, after passing Chunar, is exceedingly rough, being, in fact, a network of nullas, gullies and ravines. Between Chunar and Mirzapoor, in a distance of 21 miles there are 14 channels of more or less importance, which will demand masonry bridges, besides a great extent of broken ground, requiring numerous culverts. The material, however, of these works, and for ballast, may be quarried on the spot, and rock foundations will be everywhere attainable.

40. At Mirzapoor, as at Patna, the railway could not be brought up to the river-bank, unless by a sweeping destruction of houses and religious buildings, attended by a great interruption of thoroughfares in the city. It appears, however, that, for Mirzapoor at least, a station on the river bank is not a matter of importance; much of the merchandize is brought by land; and I am informed that even the goods conveyed by the river generally change hands at Mirzapoor. As regards the land-carried goods, and for passenger traffic, a river-station would not be convenient, as being difficult of access, owing to the narrowness of the streets; nor would it be well placed for continuing the line towards the north-west; the most eligible site for a station would probably be near the great gaol on the Jubbulpore trunk road.

41. Passing Mirzapoor, the railway would cross the Aoja Nulla, about 150 feet wide, and the head of the Bindachul Jhul, and would then skirt the sand-stone hills for five miles to the crossing of the Kurnowtee, between which and the Tonse (about 26 miles) there are no natural difficulties or impediment of any kind.

42. I was unable to extend my personal examination further than to about 22 miles west of Mirzapoor, and have not yet seen the sections taken by the railway

railway engineers between the Tonse and the Jumna; they will be forwarded hereafter with Mr. Turnbull's report.

43. The profile of the Doab, from Allahabad to Agra and Delhi, is known, from the levels taken in connexion with the Ganges canal work, to be so favourable for the construction of railways as to leave the selection of the line to be guided chiefly by political and commercial considerations. Whatever route be selected, there would be, in 400 miles, but one important river crossing, that of the Jumna, at or near Agra, and but few bridges would be required to dispose of the local drainage.

44. From Delhi to Ferozepoor, a further distance of 220 miles, the railway would traverse a country, which I could state, from personal knowledge, to be remarkably free from engineering difficulties. The Delhi and Hurriana canals and the River Cuggur are the only streams; and I believe that the only other natural obstacles would be a few belts of drifting sand, which may occasion some little trouble in keeping the line open during the prevalence of the hot winds.

45. While examining the country, with reference to the engineering operations of a railway, my attention was also turned to the prospects of its use by the natives to such an extent as to ensure a remunerative return. The goods traffic has been chiefly relied on by Mr. Stephenson, Major Kennedy and others, and I have seen no reason to doubt the realization of their hopes: the quantity of merchandize passing up and down the Ganges Valley even now is enormous; and that the merchants, both native and European, are willing to pay for a safer and more expeditious conveyance than is afforded by the native boats, is abundantly proved by the growing demand for freight on the river steamers, and by the constant use of the great trunk road for the transport of goods between Calcutta and the provinces as far as Delhi.

46. My recent observations, however, have encouraged me to hope that the passenger traffic will be an equally, if not more fruitful source of profit. The population of the Ganges Valley is remarkably dense, especially along the banks of the river, to which it is attracted by commerce, fertility of soil, and every association connected with the religion and ancient superstitions of the country. This population is very locomotive; wherever roads exist they are crowded with travellers, and the inhabitants of the principal towns freely avail themselves of facilities for increased rapidity of transport, afforded by metalled or other well constructed roads.

47. The great trunk road affords the best example of the native appreciation of rapid transit, but on other thoroughfares, and especially between Mirzapore and Benares, I witnessed a constant stream of horsed conveyances, most of them hired vehicles, but not worked by relays of horses. On the trunk road, and, as I am informed, on other roads in the North Western Provinces, the use of staging carriages, drawn by relays of horses or bullocks, is spreading very rapidly among the natives, where horses are employed, and a rate of five to seven miles an hour attained: the charge is 1 anna per mile for each individual, while in the bullock carts, whose pace may be assumed at from two to three miles an hour, the fare is half an anna per mile for each person.

48. In the course of my tour, I noticed that the better class of natives whom I met with evinced considerable interest in the object of the inquiries on which I was understood to be engaged. I have taken every opportunity of conversing with all classes on the subject, explaining to them the nature of a railway, and of the accommodation it would afford to travellers, and the probable fares. In some instances I have suspected incredulity; but I have never heard a doubt expressed that all classes would avail themselves of this means of transit whenever they might have occasion to travel on legal or commercial business, to visit their families, or for religious objects.

49. Supposing it to be the purpose of Government ultimately to connect Calcutta by railway with the North Western Provinces and the Punjab, I would take this opportunity of respectfully urging the expediency of entering at once and simultaneously on the prosecution of the entire undertaking. It need scarcely be observed, that the present plan of constructing the railway, by

successive sections, while it would indefinitely postpone the establishment of an efficient railway system, would also curtail the pecuniary returns for which each section is dependent on the distant as well as the local traffic, or, in other words, that a complete railway, or system of railways, would be more efficient for military, political and commercial objects, and more remunerative to those who pay for it, than any number of its parts, and that the cost and labour expended on such fractional portions are not bearing their full fruit, but lie comparatively unproductive, until the scheme be perfected.

50. Supposing that the requisite funds might be raised (a point on which I am not in a position to offer an opinion), the possibility of simultaneously carrying on so large an undertaking would depend on that of obtaining competent supervision in the engineering department. This may be a source of some difficulty; but I should anticipate none in commanding an adequate force of labour of all kinds within a short range of the districts through which the railway would pass. Consideration would at once be given to the provision of permanent way materials, and thus ample time would be afforded for the best and most economical arrangement for this important item of expenditure.

51. The advantages of carrying a railway through the Doab from Allahabad to Delhi having been already insisted upon by the highest authority in this country, need not be repeated here; but I would take the liberty of mentioning some circumstances which appear to me to strengthen the arguments for an immediate commencement of the work. The main line of the Ganges Canal is approaching completion, and measures will now be taken immediately for the formation of the branch canals (or rajbuhees), and their dependent systems of watercourses, by which the water will be distributed over the whole surface of the country. The railway must necessarily cross many of these watercourses, and I believe that economy of arrangement may be greatly promoted, and mutual interference obviated, if the railway and the irrigation system be laid out simultaneously and with reference to each other; I would further anticipate, that by the completion of the principal works on the Ganges Canal, much of the trained labour now absorbed by it, will be set free, and will be available for the railway, if the latter be commenced at once.

52. I defer the remarks I shall have to offer on the probable cost of the railway in its several parts until receipt of the sections and calculations of work, which will be forwarded by the chief engineer of the East Indian Railway; but it may not be out of place to suggest the plan of operations which to me appears best suited to the circumstances of the case, and to consider the description of subordinate agency to be employed.

53. It will be readily admitted by all who have had experience in public works, on this side of India at least, that in any enterprise of magnitude the chief difficulty and source of delay is the collection or preparation for the requisite quantity of building material. This fact should in great measure regulate the arrangements for construction of the railway from Burdwan to Allahabad, which may be generally characterized as consisting of several principal works, or clusters of such, connected by long portions of mere embankment. The time required for the construction of the large works will regulate that for the completion of the whole undertaking, and half of this time will be devoted to the collection of materials: I would propose, therefore, that the line be permanently set out throughout its whole length; that the gradients be definitely fixed, and the land taken; that the designs for all the principal works be prepared; that where timber or brickwork are to be employed in the construction, timely arrangements be made for the provision of the requisite material; and where iron-work is preferred, that either detailed drawings, or the necessary dimensions and conditions, be transmitted to England, so as to give ample time for its preparation and despatch on the most economical terms; in the meantime bungalows should be built for the shelter of the engineering staff, and agreements should be entered into with native contractors for the collection of natural and artificial ballast, and for the formation of all the embankments, leaving the cuttings, where not very heavy, to be executed hereafter: a small annual expense would be incurred in the maintenance of the earthwork, but its thorough consolidation would be secured, and a most valuable and timely test would be obtained

obtained of the propriety and sufficiency of the provision that may be made for the passage of floods and local drainage.

54. The plan which I have suggested, and the circumstances which I have supposed to recommend it, would not suit contractors of the class with which we are connected on the present works, but it would not be unfavourable to a man of large capital and resources, competent to undertake the construction of 100 to 200 miles of railway; or, failing these, it might be worked by petty contractors for the different classes of work, under the general management of executive or resident engineers.

55. The partial failure of the contract system with us (for such, I fear, must be confessed, as regards both economy and rapidity of construction), is attributable to causes some of which are accidental and transitory, others permanent. The former are principally the novel nature of the work, the inexperience of the English contractor in the ways of India, and that of the Indian contractors in railway work; the absence of high professional standing as railway contractors of those engaged, and the want of capital, which cramps their energies, and renders them so dependent, that no temporary suspension of monthly payments (as a penal measure) can be attempted by the railway company, without risk of stopping the works altogether. The more permanent objections are the contractor's profit, and the greater expenses necessarily involved in the contract system by the double establishment required by the contractor for supervising the work, and by the engineers for checking it; but these sources of expense would be dried up, should the railway company determine to execute the work by their own engineers; and supposing that the latter were qualified to do justice to a task confessedly new to them in many respects, it is my own opinion that fit men might be found for the executive duties, but that those of account must be provided for separately and distinctly by the employment of clerks of the works, men who combine a qualification in book-keeping with a certain knowledge of railway work.

56. I would not be understood as pronouncing positively against the further employment of rich contractors, as we now have, but I would certainly wish to be independent of them, and I have seen good reason in the progress of the present works to desire that our future operations may be entrusted to a better and more efficient agency.

(signed) *W. E. Baker,*
Consulting Engineer to Government of India.

J. P. Grant, Esq.,
Secretary to the Government of India.

REMARKS by the Consulting Engineer to Government.

22 March 1853.

My report, dated the 19th instant, will stand in the place of lengthened comment on the accompanying papers.

I would merely point out that the series of unfavourable gradients at Rajmahal may be greatly improved, and near Calgong may be avoided by a very slight detour towards the river bank. The inundated and broken ground, as shown in this section near Benares, may be avoided (as mentioned in the 37th para. of my report), by a straight course, leaving Rajghaut a few miles to the right.

The estimates are, in my opinion, considerably too high; Mr. Stephenson indeed remarks, that the works have been advisedly estimated at excessive rates; the nearest possible approximation to the truth would, I think, have been more useful, with reference especially to the purpose of inviting tenders in England.

I am sorry to find that time would not admit of borings being taken to ascertain the nature of the soil in the bed of the Soane. The large sum, no less than four-and-a-half lakhs of rupees, at which Mr. Turnbull has estimated a part only of the provisional arrangements required in substitution for a bridge at this point,

gives additional importance to the inquiry as to what would be the least cost of a bridge, the temporary substitute for which would entail so heavy an expenditure.

(signed *W. E. Baker*, Major,
Consulting Engineer to the Government of India.

J. P. Grant, Esq.,
Secretary to the Government of India.

No. 1022.

From *R. Macdonald Stephenson*, Esq., Managing Director and Agent of the East Indian Railway Company, to Major *W. E. Baker*, Consulting Engineer to Government of India.

Sir,

Calcutta, 21 March 1853.

I HAVE the honour to forward, for the information of the Government of India, the results of the surveys carried on during the past cold season.

Enclosures:
Report No. 6 of G. Turnbull, Esq., March 5th 1853.

Estimates, Plans and Sections, Nos. 1 to 7.
Map, showing alternative directions of the line above Allahabad, as laid down in 1843, in 1845 and in 1847, by the East Indian Railway Company.

Works - - - - -	Rs. 88,04,087
Surveying, Engineering, Direction, Management, Locomotives and carrying Stock - - - - -	19,95,810
..	Rs. 1,07,99,897
Works - - - - -	1,01,57,609
Additional, as above - - - - -	12,98,750
..	Rs. 1,14,56,359
* Works - - - - -	3,60,95,365
Surveying and Engineering, Direction, Management, Locomotives and carrying Stock - - - - -	71,90,000
..	Rs. 4,32,85,365

The report and estimates of Mr. Turnbull, the chief engineer, with the plans and sections specified in the margin, contain the ample details of the operations which, in addition to the trial sections taken on the direct Patna and the More and Bhaugulpore lines, have extended from Rajmahal (to which point the company had previously brought their series of levels), by the valley of the Ganges to Patna, Mirzapore and Allahabad, the route selected by the authorities to be pursued as the trunk line connecting Calcutta with the North Western Provinces.

From the estimates already forwarded, it will be seen that the cost of the 121 miles of the first or Raneegunge section will not exceed 1,07,99,897 rupees, or 89,255 rupees per mile, including all expenses of construction, surveying, management, locomotives, carrying stock and maintenance for one year after completion, both of way and works.

The section to Rajmahal is estimated to cost 1,14,56,359 rupees, or 93,906 rupees per mile, for a distance of 121½ miles, and the continuation from Rajmahal to Allahabad is estimated at 4,52,85,365* Co.'s rupees, or 1,03,156 rupees per mile, the distance being 439 miles, the crossing of the rivers Touse, Kurrunmassa, and all the other large rivers, except the Soane and the Jumna (which it is proposed to cross at first by a ferry), being included.

The first section will be completed by the latter part of next year, portions of it being opened, and locomotives with carrying stock provided, and placed upon the line, within the next few months.

The construction of this section (equal in length to the English Great Western, and exceeding that of the London and Birmingham lines) will have taken four years to construct, a period which, when all the difficulties incidental to an entirely novel description of work in India are considered, will not, it is hoped, be regarded as excessive or unreasonable. Had it been the wish of the Honourable the East India Company that a much increased length of line should have been made, the period of completion (four years) would not have been exceeded, as proportionately augmented resources would have been provided.

The extent to which during the next few years the construction of the railway lines of communication through India may be proceeded with, will depend entirely upon the views and decision of the Government of India, and of the Court of Directors of the East India Company.

As regards the practicability of widely extended and simultaneous operations, and with a view to a clear understanding of the state of preparation of the East Indian Railway Company to carry out the intentions of the home and local authorities, I take the opportunity to state, that the Railway Company, being empowered under the Act of Parliament to raise the necessary amount of capital, are prepared within seven years, viz., between the 1st October 1853 and the end of 1860, to complete the entire line of railway communication by the Ganges Valley, through Mirzapore to Delhi, and if desired, within the same period

period to construct a further extension to Lahore, and a branch line through the Soane Valley, to connect Calcutta with the Bombay Presidency.

The statement is made upon data which have been in course of careful collection during the last 10 years, and, from personal examination and knowledge of the country as far as Delhi, confirmed in all respects by the full and able reports of the engineer officers in the East India Company's service.

The accomplishment of a design which, in reference to the advantages derived both by the Government and the public, will be admitted to deserve the serious consideration of Government, must depend upon an early decision, upon advantage being promptly taken of the favourable state of the money market in England, and upon the exercise of the necessary foresight in providing those means and appliances which involve time as a primary and essential element.

The cost of the line to Allahabad, complete, and including locomotives and rolling stock, having been advisedly estimated at excessive rates, to provide for the increased cost of iron and freight, will not exceed 6,75,41,821 rupees, upon 681½ miles, or an average of 96,300 rupees per mile. The probable cost above Allahabad may be estimated at 60,000 rupees per mile, the items of permanent way materials in both cases being liable to fluctuation from the varying price of iron.

The statement made officially to Parliament, that railway communication shall be made throughout India, and the decision by the authorities of the general direction of the route between Calcutta and the North Western Provinces, have removed the only two preliminary questions, which might have required longer delay in deciding upon the period at which future extensions in the Presidency of Bengal and the North Western Provinces should be made, and 2,000 miles can now be constructed by the Railway Company within the same period that will be occupied in completing 200 miles.

Should the Government of India consider the communication now forwarded to justify the Government in recommending that the construction of the entire lines of communication above referred to should be at once provided for, and that the instrumentality of the East Indian Railway Company, under the full and direct control of the Government, offers the most suitable means by which it can be accomplished, I feel assured that extraordinary exertions, proportioned to the importance of the undertaking, will be promptly made by the Directors of the Railway Company to ensure the due fulfilment of their contract; and I venture to express a hope that the mode of administering the affairs of the Company both in England and in India, in connexion with and under the control of the authorities, has been such as to deserve and secure their continued confidence.

I have, &c.

(signed) R. Macdonald Stephenson,
Managing Director and Agent.

EAST INDIAN RAILWAY REPORT, No. 6.

From George Turnbull, Esq., to the Chairman and Directors of the
East Indian Railway.

Gentlemen,

Serampore, 19 March 1853.

1. I HAVE now the honour of transmitting to you a plan, longitudinal sections and estimates of the proposed extension to Allahabad, on the lines which have been the subject of careful investigation during the months of November, December, January and February last.

2. My report on this subject must necessarily be brief, on account of the necessity which exists of submitting the documents to the Government of India for consideration without delay.

3. In order to meet your wishes, and those of the Government with respect to the cost of the works, I have devoted the short interval which has elapsed since the completion of the trial surveys to the preparation of minute and careful estimates, not only of all the proposed extensions to Allahabad, but also of the 121 miles now in course of construction, in preference to attempting any very detailed description of the country traversed, which description must now be made in general terms.

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4. The first part of the extension, namely, that between the junction, a few miles west of Burdwan and Rajmahal, is fully described in my report of the 23d February 1852. Orders having been received to proceed with the surveys on this portion, I detached Mr. Sibley from Chandénagore, and put him in charge of the 45 miles from the junction to the River More. Since the month of November the country has been re-examined, the centre line marked out on the ground, the working longitudinal section taken, and the surveys of properties necessary for obtaining possession of land are drawing towards completion. Some have been already finished and sent in to Government. The designs of the works are also in progress.

5. On the length of about 76 miles from the River More to Rajmahal, nothing more has been done besides that which is described in my last report, because the number of engineers available was not more than sufficient to take the trial-levels up to Allahabad, and the alternative routes by Chuckai, and by the valley of the River More. It was deemed more advisable to ascertain the facts of the alternative routes suggested, and settle that much-debated question, and secure sections and accurate estimates up to Allahabad, than to prosecute the setting out of the line beyond the River More. This work will, however, be resumed as soon as it is possible to take the field after next rainy season.

6. I now proceed to a short account of the line from Rajmahal westwards. You are already in possession of a plan and longitudinal sections up to Rajmahal. For the sake of distinctness, I shall state all the estimates together in a tabular form at the end of this report.

7. The course proposed is indicated by a strong red line on the map. Commencing near Oodwa Nullah, the main line will take what may now be called the Oodwa Nullah or Rajmahal branch, about six miles from the River Ganges. The line here bends to the left, and turns the flank of the first of the Rajmahal hills, rising at the rate of 1 in 500. The line still bends to the left, and then to the north, keeping between the hills and the large swamp called the Jālā Jheet.

8. The soil here is favourable, and the works will not be attended with difficulty; there is a good deal of quartz rock, but what appears on the surface is of a loose friable nature, and excellent ballast can be obtained to any amount.

9. We next reach the old military station of Sickrugully (now deserted), keeping to the south of the rocky promontory, after having passed the remains of the ancient Mahomedan road, near a place where traces of coal have been found.

10. At Sikragully the line bends into nearly a due-west course, passing the out-lying hill of Gunga Persaud on the north, and on the old ruined fortress of Taleagurne, at which place the railway must keep close to the foot of the rock on which the ruins stand. This is the last of the rocky hills which must be passed. It is composed of basaltic boulders and red soil, and some quartz pebbles.

11. The direction is now straight to Colgong, where there should be a station and landing wharf in the River Ganges. East of Colgong the country is very jungly; but clearing is going on rapidly, and cultivation spreading.

12. From Rajmahal to Colgong the distance is about 50 miles.

By reference to the section, it will be seen that we have gradients of 1 in 300, 1 in 400, and 1 in 500, &c. I should remark here, that these gradients are capable of improvement, either by incurring the expense of heavier works, or by making bends or curves to the right or left, all which can be decided at the time of making the working sections, when the estimates of alternative lines can be compared.

13. From Colgong to Bhaugulpore, about 20 miles, the country is inundated by the annual overflowing of the Ganges. The high land is, as usual, found close to the margin of the river, and the line should be carried at no great distance from the present dawk road, and as near to the river as it would be prudent to place it, so as to avoid any danger to the works from the encroachments of the floods of the Ganges.

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14. A stiff red clay appears at intervals in the bed of the river, which promises well for foundations of our bridges, of which there will be several in this length; one over the Koah Nuddy, another over Geroah Nuddy, and another over the Ghoga Nuddy, are the largest. A proportion of flood-openings will also be necessary.

15. We now reach the large and important station of Bhaugulpore. Two trial lines were taken here; but on more examination, we found that a third route would possess advantages over either of those shown on the plan and section. Here a large station and a communication with the river should be established.

16. From Bhaugulpore to Monghyr the distance is 32 miles by the line; more than half of this distance is subject to an annual inundation. It does not, however, appear that the works will be of a difficult character on the whole, as for a considerable distance an elevated natural bank occurs between the river margin and the railway works.

17. The principal rivers to be crossed are the Chumpan Nuddy, about 300 feet wide, besides a large extent of flooded ground on each side of it, and the Mun Nullah, about 350 feet wide. About half way stands the large thriving village and bazar of Sultan Gunge, close to the rocky promontory and Island Jehaгурah, with its temple and ruined mosque. These rocks permanently define the margin of the River Ganges at this place, and no alteration, it is stated, has ever occurred in the course of the river here, where there is always deep water, and a good landing place.

18. We now turn the end of the Kurrukpoore hills, and reach Monghyr by an easy curve. Future investigation must decide whether it be most advisable to bring the line close to the town, or carry a short branch down to the river banks, and keep the main line at a few miles distance. The trial section shows the line as laid down on the map.

19. From Monghyr, westwards, for above 30 miles, the country is inundated every year; two trial sections were taken, which are shown on the plan, one keeping near the River Ganges, passing a short distance south of Soorujgurrah; the other route keeps a direction more to the south, near the base of the hilly range, and is almost beyond the reach of the inundations, and, which is of more importance, passes through better soil, saves two bridges, and avoids the black alluvial earth called curco, which is about the worst possible material for making embankments. This line has been adopted for the estimates; it is about five miles longer than the other, but its advantages more than counterbalance the extra length of permanent way.

20. The Keal and the Hullohur rivers must both be crossed; both will require large and expensive bridges; that over the Hullohur will be the most formidable. The Hullohur bridge will be 650 feet long, and with an average depth of about 40 feet.

The Keal bridge will be about 500 feet long, and considerably less in height than the other; for both these bridges estimates have been made of cast-iron cylinders, and light wrought-iron superstructures. The applicability of such a construction can better be decided when the beds of the rivers are examined by borings and otherwise.

21. After crossing the Hullohur, the best direction will be northwards by Burheea, and keeping close to the high land on the banks of the river, passing the thriving village of Baar, and on westwards by Futwa, across the Poonpoon Nuddy, to the city of Patna. From the Hullohur to Patna the distance is about 63 miles; there are villages all the way, and the country is rich and in high cultivation. For nearly the whole of this distance the works will be out of reach of the inundations.

A bed of good red clay appears at intervals in the bed of the Ganges, which in a great measure prevents its south margin from being washed away by the stream during the time of floods.

22. The Poonpoon bridge will be a large and expensive work; an estimate of it has been made on the same principle as that for the River Hullohur.

23. Some low land occurs west of Futwa partially flooded, which will require to be provided with arching, or openings for the passage of the floods.

24. The best line for the railway through the city of Patna, will be on the old earthen mound or rampart, which runs east and west for a mile and a half, at a distance of three and a quarter miles from the river. The line here has some very favourable features, as the city can be traversed without the destruction of any valuable property. The old mound alluded to is stated to be the property of Government. The best site for the Patna passengers' station will probably be at the race course or Mydan, at the west end of the city. A good station may be made at any convenient point in the city opposite to the opium factory, or at such other point as may appear preferable.

25. From Patna to the River Soane two trial sections were taken, one touching Dinapore, and proceeding south-west to the small village of Purreo on the Soane; the other route goes by Phoolwarree, keeping considerably to the south of the other line, and is a much better one, inasmuch as it escapes a large extent of low inundated land, south and west of Dinapore, which would require large embankments, and many flood passages. The line by Phoolwarree is that which has been estimated.

River Soane.

26. The River Soane has been examined as far up as the crossing of the grand trunk road, and no better place of crossing has been found than that at the village of Pareu, at the south end of a small island.

At this place the banks are steep and well defined, and the clay bottom is occasionally visible, and, especially on the east side, appears of a more tenacious character than usual.

The earliest opportunity should be taken to sink wells and borings into the bed of the river, to ascertain the nature and depth of the soil and substratum.

No estimate has been made of a bridge across the Soane; first, for want of data; and, secondly, because the construction of a bridge is manifestly a work of so great expense, that it is worth consideration whether it would not be best to have a "break" in the railway, and a ferry, and landing piers for transport of goods and passengers, which can be done at a comparatively light cost, leaving the construction of a bridge until the increase of traffic should demand one.

If a "break" occur here, it would be necessary to have a station on each side of the river, with engine-sheds and turntables for reversing the engines, and other arrangements peculiar to a terminal station; for these I have made an approximate estimate.

27. Leaving the River Soane, the line proceeds nearly due west, in a perfectly straight direction, through a fertile and populous country, passing to the south of the large town of Arrah, where there is a civil station for the district of Shahabad. Here many flood-openings or arches will be wanted, as the country is in part inundated, principally from the overflows of the River Soane.

28. We then proceed on a straight line westwards, on the north side of the Buheea and south of Bhojpoor, approaching the Ganges near Buxar.

The soil of the whole of this part is the ordinary alluvial clay, well adapted for brick and ballast burning in most places; but little kunker limestone is met with. The whole country is almost a dead level, and in a state of high cultivation.

29. From the River Soane to Buxar, the distance is 51 miles, and in that distance bridges will be wanted for the river near Arrah, for the Bunnas Nullah, for the Ganges Nullah, the Kao Nullah, and Bhynsacc; none of these will be formidable works; their beds are almost dry during half the year.

30. At Buxar is a part of the large establishment for the breeding of cavalry and other horses, kept up by the Government of India; otherwise, it is not a place of much importance; it is, however, well situated on the banks of the Ganges, and opposite the old fort there is deep water; and an excellent landing-place for steamers and native craft could be established here with advantage. Part of the stud of horses is on the north and part on the south side of the Ganges.

31. A station

31. A station should be built at Buxar. The line now bends to the left ; keeping a short distance from the Ganges, crosses the Thora Nuddy, passes the large native village of Chowsa, and on to the crossing of the River Khurramnassa.

32. The bridge over the Khurramnassa will be a heavy and expensive work ; the channel is about 600 feet wide, and about 47 feet in depth ; the rise and fall of the flood-waters is great : the soil seems stiff clay. I have estimated this bridge to be built with cast-iron cylinders, and a light iron superstructure ; but until careful borings are taken, and other investigations made, the propriety of this or any other design is not to be decided.

33. On leaving the Kurrumnassa, the line now goes westward, keeping in the highest ground between the Kurrumnassa and the Ganges ; it then approaches a bend of the Ganges near Lumaneeah, and afterwards proceeds nearly straight to Raj Ghaut, opposite the city of Benares, where a station may conveniently be built.

34. No heavy works will be wanted between the Kurrumnassa and Raj Ghaut ; the country is almost a dead level, and the bridges and culverts are under the average.

The distance from Buxar to Benares is six and a half miles.

35. Leaving Raj Ghaut the country is occasionally flooded, but not every year. The line then passes Ramnuggur, a large village of some pretensions, with a Rajah, a palace, and a good bazar.

36. About 15 miles from Benares is the first crossing of the River Jurgoo, and the second is at 19 miles ; both these will require large bridges. We now reach Chunar, where a good station should be built. The sandstone hills in this neighbourhood an inexhaustible supply of the finest building stone.

37. For a distance of 11 miles west of Chunar, the surface of the country is in general rough, and broken up into small ravines and gullies, cut by the rain-water. Many bridges will be required, about 24 in number ; but none are of any magnitude, except that over the Belwun, which has been estimated in a similar manner to the Poonpoon and others already described.

38. At Poonah Hill, a cutting of about two miles in length, through sandstone, will be necessary ; the sandstone seems easily worked, and is a good building material.

39. From the above to Mirzapore, nine miles, the country is level, and the works light, with the exception of one bridge, 198 feet long, over the Khujeree Nuddy.

40. The best site for the station at Mirzapore formed the subject of discussion with the authorities there, and with some of the principal merchants ; the site near the hospital at the crossing of the great Jubbulpore road seems to possess the greatest advantages.

Mirzapore being the chief commercial city of these Provinces, a large amount of station buildings will be required, and branch lines to the river ; it is probable also that this will be found to be the best place for locomotive sheds, workshops and repairing shops, as here skilled native workmen can be found, and many other facilities exist.

Mirzapore is 576 miles from Howrah by the line of railway.

41. From Mirzapore to Allahabad the distance is 52 miles.

The average cost of the works will be low ; but several expensive parts occur, such as the bridge over the Ojhla, the Kurrowtee bridge, the embankment across a swamp west of the Kurrowtee, and the great bridge over the River Touse.

42. I have not gone into an estimate of a bridge over the Jumna, for the same reason which I have explained with reference to the River Soane.

43. A temporary station should be placed on the east bank of the river opposite Allahabad, and the traffic carried on, as at present, by the bridge of boats ; this station would be 628 miles from Howrah.

44. An alternative line of railway was pointed out by Mr. Oldham in his Geological Report on the coal-producing districts of Damoodah and Bheerbhoom. Of this line I have made a careful examination; and trial sections have been taken, connecting it with the sections of the other lines.

I was requested to report on Mr. Oldham's suggestions, and made my comments thereon in a letter to Major Baker, dated the 18th August 1852, and it may not be necessary to repeat these remarks here.

The trial section accompanies this paper; it will be seen that the gradients are unfavourable; but there is nothing insuperable, or even of much difficulty, in the line, except at one place, a few miles north of Chuckai, where the line must traverse a broken country, intersected by deep ravines, the sides of which are covered with jungle, and the rocks of the hard gneiss formation, intersected by masses of whinstone and quartz.

A road passes through it circuitously at a place called Betteah Ghat, a little to the east of the gorge through which the River Burnur discharges itself.

The part so described is eight miles broad, and the descent is so rapid, that no better gradient can be obtained than one in 58 for four miles, and not without deep cuttings through these rocky hills; the only alternative is a tunnel, which in such a place should not, I think, be entertained.

On account of the above objections, I have not considered it necessary to make any estimate of this line.

45. I have also made an examination of another alternative line, diverging near Sooree, and following the valley of the River More, proceeding by Nori Haut, nearly straight to Bhaugulpore.

This one suggested itself to me when examining the country near Sooree.

A trial section is annexed, and an estimate of the works.

46. The country traversed by it for the greater part of the way is of a jungly and wild description, and we cannot expect much, if any accession of traffic after leaving Sooree, until we reach Bhaugulpore, a distance of 110 miles.

47. The gradients are, 1 in 1,000, 1 in 700, and 1 in 450; and on the north side of the summit a gradient of 1 in 300 for 14½ miles; anything better than these need not be anticipated.

48. For a considerable length the railway must be made through the prevailing gneiss rocks, the excavations in and through which will occupy time.

To counterbalance which, however, an ample supply of ballast will be met with.

49. I consider it to be my duty to lay before you the engineering facts and peculiarities of these routes; there are no very important difficulties in either, that is, between Sooree and Rajmahal, and between Sooree and Bhaugulpore direct.

50. It will be for you to decide the question whether the commercial advantages of the Rajmahal line traversing a more fertile and populous country, confessedly at present without means of transport for its valuable products, gaining whatever goods traffic may accrue by opening up the country between the River More and Rajmahal, carrying passengers so far as Rajmahal on their way to Darjeeling, and other parts, and gaining the competition with the uncertain Ganges and Bhaugrutty, for the rich traffic of Purneah, should not decide you to adhere to the route *via* Rajmahal.

I may also call your attention to the fact, which should have been stated in the engineering part of the question, that it will be seen, by inspection of the sections, that the summit near Nori Haut on the More line is 447 feet above the summit by the other line; so that all commodities destined for the Calcutta market must be taken up to that extra height—an important point as regards locomotive power, and an offset against the additional 25 miles of the Rajmahal route.

51. Under these circumstances, and having been informed that the extension to Rajmahal has received sanction, and that capital is ready to execute it, I shall, unless countermanded, make such arrangements as are in my power to prosecute the works to that place as speedily as possible.

52. With

52. With this view, I have indented for two more assistant engineers, who should be sent out as soon as possible, to take the field immediately after the rainy season, now approaching.

I shall also require two more European inspectors skilled in brickwork.

53. In conclusion, I would respectfully call your attention to the importance of proceeding simultaneously with all the works enumerated in this report. The general establishment would not thereby be greatly increased; but, as regards the final completion of the whole, the advantages are incalculable.

54. For example, in all heavy embankment across inundated lands, the banks should be thrown up at once, leaving gaps equal to the openings of the bridges. This would enable us to decide the difficult question as to the right area for the passage of the floods, by watching the effects of the first year's inundation, and might, on the one hand, save much expenditure in superfluous flood-openings, and, on the other hand, might prevent serious disasters, by constructing too few of them.

55. Secondly, in those places where large rivers must be crossed, such as the Hulohur, Poonpoo, the River Khurrunnassa, and the River Touse, and whose bridges would occupy a much greater time in construction than other parts of the works, a commencement cannot be made too soon.

56. I recapitulate the estimates in the Table as follows, adding the electric telegraph, necessary for the safe working of a single line.

		Distance. M.	Co.'s Rs. a. p.		
1st.	Works in hand from Howrah to Raneegunge	- 121	88,04,087	13	5
2d.	Works sanctioned from near Burdwan to Rajmahal	121½	1,01,57,809	12	-
3d.	Works proposed from Rajmahal to Allahabad	- 439	3,80,95,365	10	2
4th.	Works at the crossing of the River Soane	- - -	4,50,000	-	-
5th.	Electric Telegraph, 782 miles, at per mile, 100 l.	- - -	7,82,000	-	-
Co.'s Rs.			5,82,89,263	3	7

I have, &c.
(signed) Geo. Turnbull.

(True copies.)
(signed) R. Macdonald Stephenson,
Managing Director and Agent.

A. EAST INDIAN RAILWAY.

SUMMARY OF ESTIMATES.

—	DESCRIPTION.	TOTAL COST.			COST PER MILE.		
	WORKS now in Progress:	Co.'s Rs.	a.	p.	Co.'s Rs.	σ.	p.
121	Miles from Howrah to Raneegunge, including Howrah and other stations -	88,04,087	13	5	72,761	-	-
	EXTENSION to RAJMAHAL:						
	For a single Line of Railway:						
45	Miles from near Burdwan, to the River More - - - - -	35,33,540	-	-	78,523	-	-
76½	Miles from the River More to Rajmahal -	66,24,269	12	-	86,507	-	-
242½	Miles. Co.'s Rs.	1,89,61,597	9	5	78,112	-	-

19 March 1853.

(signed) Geo. Turnbull.

B.
EAST INDIAN RAILWAY.

SUMMARY OF ESTIMATES.

MILES.	DESCRIPTION.	TOTAL COST.			COST PER MILE.		
	EXTENSION from RAJMAHAL to ALLAHABAD, for a single Line of Railway:	<i>Co.'s Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Co.'s Rs.</i>	<i>a.</i>	<i>p.</i>
77	Rajmahal to Bhaugulpore - - -	60,55,131	-	-	78,638	-	-
157½	Bhaugulpore to the Soane - - -	1,38,76,873	-	-	88,294	-	-
112¾	River Soane to Benares - - -	96,03,216	10	2	85,172	-	-
92	Benares, <i>via</i> Mirzapore to Allahabad -	85,60,145	-	-	93,045	-	-
439	Miles.	<i>Co.'s Rs.</i>	3,80,95,365	10 2	86,777	-	-

19 March 1853.

(signed) Geo. Turnbull.

C.

MEMORANDUM of Estimate of the Line by the Valley of the River More.

		<i>Co.'s Rs.</i>	<i>a.</i>	<i>p.</i>
118½	Miles from the junction near Sooree, by Noni Hât to Bhaugulpore - - - - - Or, per mile, Rs. 79,634.	94,56,518	-	-
	COMPARISON of the MORE VALLEY Route with that by RAJMAHAL:			
67	Miles from the River More to near Oodwa Nullah - -	57,74,060	-	-
77	Miles from ditto to Bhaugulpore - - - - -	60,55,131	-	-
144	Miles.	1,18,29,191	-	-
118½	Miles as above - - - - -	94,56,518	-	-
25½	Miles difference	<i>Co.'s Rs.</i>	23,72,673	-

19 March 1853.

(signed) Geo. Turnbull.

D.

MEMORANDUM as to the River Soane.

If, as I suppose, a "break" in the line should be made at the River Soane, until the increase of traffic may render the construction of a bridge advisable, it will be necessary to provide two stations, one on each side of the river, with engine-sheds, carriage-sheds, large 42 feet turntables, for reversing the engines and tenders, and other accommodations peculiar to a terminus of a long line of railway.

I assume each of these stations to cost 1,50,000 rupees: for two stations at the Soane - - - - - *Co.'s Rs.* 3,00,000
Ferry-boats, landing-piers, wood platforms on the land,
and other arrangements for facilitating the traffic
across the river, say - - - - - 1,50,000

Co.'s Rs. 4,50,000

19 March 1853.

(signed) Geo. Turnbull.

NOTE E.

The aggregate number of miles which have been examined, and of which the trial sections have been taken this last cold season, including November, December, January and February, amounts to 818.

To do this, six working parties of engineers were employed, which gives an average of 156 miles to each party.

The parties so employed were Messrs. Vigors and Denham, between Rajmahal and Monghyr.

Messrs. King and Fox between Monghyr and the River Soane.

Mr. Claxton from the River Soane to Benares; Mr. Lancey, from Benares to Allahabad; Messrs. Perry and Bourne from Ahsensole by Chuckai, near the Ganges.

Messrs. G. and H. Smith on the More Valley Line.

19 March 1853.

(signed) *Geo. Turnbull.*

EAST INDIAN RAILWAY.

MORE VALLEY LINE.

ESTIMATE of Cost of Works on a Line of Railway commencing at a Point on the Rajmahal Line near Sooree, following the Valley of the River More by None Hât, and terminating at Baugulpore, being a Length of 118½ Miles.

				Co.'s Rs. a. p.
Earthwork	- -	250,000,000 cube feet of clay, at per		
		1,000 cube feet - - - -	3/8	8,75,000 - -
		120,651,353 cube feet of rock, at per		
		1,000 cube feet - - - -	8/	10,18,310 13 2
Brickwork	- -	3,656,750 cube feet, at per 100 cube feet	22/	8,04,485 - -
Wrought Iron	- -	Superstructures of 20 openings, of 80 feet each, for the Sedh and other Nuddies, each	12,000	2,40,000 - -
Ballast	- -	14,256,000 cube feet natural ballast in main line, at per 100 cube feet - -	4/	5,70,240 - -
		4,714,400 cube feet burnt clay, for main line, at per 100 cube feet - -		
		1,425,000 cube feet natural ballast in sidings and stations, at per 100 cube feet - -	4/	57,024 - -
		471,440 cube feet burnt ballast in sidings and stations, at per 100 cube feet - -	6/	28,286 6 4
Permanent way materials	- -	130½ miles of permanent way, being 10 miles per cent. added for sidings and stations, at per mile, Co.'s Rs. 26,67,000 - - - -	- -	34,80,435 - -
Laying permanent way	- -	130½ miles, at per mile 5,280 rupees - -	- -	6,89,040 - -
Turntables, &c.	- -	Turntables, water-cranes, switches, crossings, &c., on 118½ miles, at per mile 1,000 rupees - -	- -	1,18,750 - -
Fencing	- -	118½ miles fencing, at per mile 2,000 rupees - - - -	- -	2,37,500 - -
Stations	- -	Sooree Roomrabad, None Hât, Dauka, and others, say - - - -	- -	2,00,000 - -
				86,96,835 3 6
		Add for Contingencies, 10 per cent.	- -	8,59,683 8 4
		TOTAL for 118½ miles - -	Co.'s Rs.	94,56,518 11 10

Or per mile, Co.'s Rs. 79,634.

19 March 1853.

(signed) *Geo. Turnbull.*

SUMMARY OF ESTIMATES.

Miles.		TOTAL COST.			Average Rate per Mile.		
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
121	WORKS now in PROGRESS : Miles from Howrah to Runceegunge, including Howrah and other stations - - -	68,04,087	13	5	72,761	-	-
	EXTENSION to RAJMAHAL for a single Line of Railway :						
45	From near Burdwan to the River More -	35,33,540	-	-	78,523	-	-
76½	From the River More to Rajmahal -	66,24,260	12	-	86,308	-	-
242½		<i>Rs.</i>	1,80,01,800	0 5	78,112	-	-

19 March 1853.

(signed) Geo. Turnbull.

EXTENSION from RAJMAHAL to ALLAHABAD for a Single Line of Railway.

Miles.		TOTAL COST.			Average Rate per Mile.		
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
77	Rajmahal to Bhaugulpore - - - -	60,55,131	-	-	78,638	-	-
157½	Bhaugulpore to the Soane - - - -	1,38,76,873	-	-	88,204	-	-
112½	River Soane to Benares - - - -	66,03,216	-	-	85,172	-	-
92	Benares via Mirzapore to Allahabad -	83,60,145	-	-	93,045	-	-
430		<i>Rs.</i>	3,80,95,365	- -	80,777	-	-

19 March 1853.

(signed) Geo. Turnbull.

MEMORANDUM of Estimate of the Line by the VALLEY of the RIVER MORE.

		TOTAL COST.		
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>
118½	Miles from the junction near Nane by Nane Hât, and to Bhaugulpore, at rupees - - Or per mile, 79,634 rupees.	94,56,518	-	-
	COMPARISON of the MORE VALLEY Route with that by RAJMAHAL :			
67	Miles from River More to near Oodwa Nullah	57,74,060	-	-
77	Miles from River More to Bhaugulpore	60,55,131	-	-
144	Miles - - - - -	1,18,29,191	-	-
118½	Miles - - - - -	94,56,518	-	-
25½	Miles difference - - - - -	<i>Rs.</i>	23,72,673	- -

19 March 1853.

Geo. Turnbull.

(True copies).
(signed) R. Macdonald Stephenson,
Managing Director and Agent.

EAST INDIAN RAILWAY.

ESTIMATE of Cost of Works in that Part of the Line commencing near Oodwa Nullah, Rajmahal, and proceeding along the South Shore of the River Ganges, by Sikragully and Calgong, and terminating at Baughpore, a Distance of 77 Miles, 15th March 1853.

			Rate.			
				Rs.	a.	p.
Earthwork	-	36,225,400 cube feet in cuttings in clay, at per 1,000 cube feet	3/8	1,26,780	4	-
	-	14,370,720 cube feet in rock, at per 1,000 cube feet	3/8	1,14,965	12	-
	-	128,370,810 cube feet in embankment, at per 1,000 cube feet	3/8	4,31,797	13	-
	-	8,167,488 cube feet in sidings, at per 1,000 cube feet	3/8	28,686	3	-
	-	8,000,000 cube feet in road approaches and level crossings, at per 1,000 cube feet	3/8	28,000	-	-
Brickwork	-	4,217,300 cube feet brickwork, at per 100 cube feet	20/	8,43,460	-	-
Ballast	-	12,196,800 cube feet for 77 miles.				
	-	609,840 cube feet, 5 per cent. for sidings.				
	-	12,806,640 cube feet, say one-half natural ballast and half burnt clay.				
	-	6,403,320 cube feet burnt clay, at per 100 cube feet	6/	3,84,199	-	-
	-	6,403,320 cube feet natural ballast	4/	2,56,132	-	-
Memo.—ESTIMATE of One Mile of Permanent Way :						
				Rs.	a.	p.
		1,760 sleepers, at per each 3/		5,280	-	-
		3,520 chains, 35 tons, at per ton 80/		2,800	-	-
		8½ tons of fishing plates, screws, bolts, nuts, at per ton 160/		1,275	-	-
		120 tons of rails, assumed price :		£.	s.	d.
		Shipping in England, per ton		10	-	-
		Freight to Calcutta		3	-	-
		Carriage to the works		1	-	-
		Co.'s Rs. 130		£. 13	-	-
						= 16,770 - -
		3,520 keys, at per 1,000 Co.'s Rs. 55/		193	-	-
		7,040 trenails at per 1,000		352	-	-
		Per Mile		26,670	-	-
Permanent way	-	77 miles.				
	-	7 miles added for stations and sidings.				
	-	84 miles permanent way, at per mile Rs. 26,670		22,40,280	-	-
Laying permanent way	-	84 miles, at per mile Rs. 5,280		4,43,520	-	-
Gates at level crossings	-	120 gates, at per each	50/	6,000	-	-
Fencing	-	25,000 linear feet, at level crossings	70/	17,500	-	-
Road metal	-	200,000 cube feet at level crossings and road approaches, at per 100 cube feet	4/	8,000	-	-
Fencing	-	77 miles fencing, at per mile, Rs. 2,000		1,54,000	-	-
Road-side stations	-	Assume the same proportion as on the Sooree district.				
	-	77 miles, at per mile Co.'s Rs. 1,855		1,27,435	-	-
Baughpore station	-	Similar to that at Rajmahal		1,50,000	-	-
Turntables, &c.	-	Turntables, water-cranes, switches, crossings, &c., assume same proportion as on the Sooree district.				
	-	77 miles, at per mile Rs. 1,000		77,000	-	-
Bridges	-	Add iron superstructure for one bridge of 5 openings, at 80 feet each, over the Geroah Nuddy, at Rs. 11,000 each		55,000	-	-
	-	Add pumping water and getting in foundation of iron bridges, each at Co.'s Rs. 3,000		12,000	-	-
Contingencies	-	Add 10 per cent. for contingencies		55,04,965	-	-
				5,50,466	-	-
		TOTAL for 77 Miles	Co.'s Rs.	60,55,131	-	-
		Or per mile, Rs. 78,638.				

19 March 1853.

(signed) Geo. Turnbull.

ESTIMATE of Cost of Works from Bauglepor, by Moonghyr, Barr and Patna, to the East Bank of the River Soane, being a Distance of 1,576 Miles.

		Rate.		
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Earthwork	380,000,000 cube feet in embankments and outtings, including sidings, &c., at per 1,000 cube feet	3/8	13,30,000	-
Road approaches	17,000,000 cube feet in banks, at per 1,000 cube feet	3/8	59,500	-
Brickwork	10,432,566 cube feet of brickwork, at per 1,000 cube feet	20/	20,86,513	-
Ballast for 157½ miles	24,895,200 cube feet ballast, burnt clay. 1,244,756 cube feet, 5 per cent. add for sidings. 26,139,956 cube feet, at per 100 cube feet	8/	20,91,196	-
<i>Memo.—ESTIMATE of One Mile of Permanent Way:</i>				
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>
	1,760 sleepers, at each 3/	5,380	-	-
	3,520 chains, 35 tons, at per ton 80/	2,800	-	-
	8½ tons fishing plates, screws, bolts, nuts, &c. at 150/	1,275	-	-
	129 tons of rails, assumed price :	£.	s.	d.
	Shipped in England	-	10	-
	Freight to Calcutta	-	2	-
	Carriage from Calcutta to works	-	1	-
	Co.'s Rs. 130	£. 13	-	16,770
	3,520 keys, at per 1,000 55/	193	-	-
	7,040 trenails, at per 1,000 50/	352	-	-
Permanent way	157½ miles. 14½ miles add for stations and sidings.		26,670	-
	172 miles, at per mile Rs. 26,670		45,87,240	-
Laying permanent way	172 miles, laying permanent way, at per mile 5,280		9,08,160	-
Gates at level crossings	200 gates, at per each	50/	10,000	-
Fencing at - ditto	42,000 linear feet fencing, at per 100 feet	70/	29,400	-
Road metal at levelling crossings.	333,000 cube feet, at road approaches, at per 100 cube feet	6/	19,980	-
Fencing	157½ miles fencing, at per mile Rs. 2,000		3,14,333	-
Road-side stations	Assume the same proportion as Sooree district. 157½ miles, at per mile Rs. 1,655		2,60,111	-
Moonghyr station	Similar to Bhauglepor		1,50,000	-
Patna station			2,50,000	-
Turntables, &c.	Turntables, water-cranes, switches, crossings, &c., same proportion as on the Sooree district. 157½ miles, at per mile Rs. 1,000		1,57,166	-
Iron work in bridges	Iron work in bridge over Kulloohurnuddee. <i>Note.—Cast-iron cylinders, 9 feet diameter, 1 inch thick, weigh 9½ cwt. per foot; flanges 9 cwt. each; cylinders cast in lengths of 9 feet.</i> 14 columns, 66 feet each, 840 × 10½ cwt., 441 tons, cast in London Freight to Calcutta Insurance, 5 per cent. Unloading at Calcutta, and leading in boats, and discharging at Nuddy Fixing in place of sinking	£. 16		
	441 tons, at per ton Co.'s Rs. 160/		70,560	-
	In 84 joints of pipe, each 2 cwt.			
	168 cwt. of wrought iron, in screw-bolts and nuts, for flanges, at per cwt.	10/	1,680	-
	Iron superstructure as before, 7 openings at Rs. 11,000 each		77,000	-
	<i>Note.—The estimate of Hullohur Nuddy Bridge, 600 feet long, Rs. 1,49,240, estimate per linear foot, say Rs. 250.</i> IRON WORK IN KIENT NULLAH: 500 feet long, at per linear foot Rs. 250 IRON WORK IN POONPOON NUDDY: 350 feet long, at per linear foot Rs. 250		1,25,000	-
			87,500	-
	Add contingencies, 10 per cent.		1,26,15,339	-
			12,61,534	-
	TOTAL for 157½ Miles	Co.'s Rs.	1,38,70,873	-
	Or per mile, Co.'s Rs. 88,294.			

17 March 1853.

(signed) Geo. Turnbull.

EAST INDIAN RAILWAY.

ESTIMATE of the WORKS on that Part of the Line commencing on the Left or West Bank of the River Soane, proceeding by Arrah Buxar, and terminating at Raj Ghant, opposite Benares, being a Distance of 112½ Miles.

		Rs.	Rs.	a.	p.
Earthwork	- - 281,256,700 cube feet earthwork in cuttings and embankments, at per 1,000 cube feet	3/8	9,84,398	7	1
Brickwork	- - 7,441,500 cube feet brickwork in bridges and culverts, &c., at per 100 cube feet	20/	14,88,300	-	-
Ballast	- - 19,819,800 cube feet burnt clay, including sidings, at per 100 cube feet	7/	13,87,386	-	-
Laying permanent way	123 miles of permanent way, at per mile	5,280	6,49,440	-	-
Permanent way materials.	123 miles, at per mile 28,607½ rupees	-	35,06,422	8	-
Fencings	- - 112½ miles of fencing, at per mile 2,000 rupees	-	2,25,500	-	-
Gates at level crossing	250 gates, each at -	60/	15,000	-	-
		Rs.			
	Arrat - - - - -	-	40,000		
	Becheea platform - - - - -	-	2,000		
	Bhogpore platform - - - - -	-	20,000		
	Buxar - - - - -	-	40,000		
	Chowra and wharf - - - - -	-	20,000		
	Teemeneah - - - - -	-	16,000		
	Seekuldeah - - - - -	-	16,000		
		-	1,36,000	-	-
	Add for sundry small road stations, say 15, at 1,000 rupees each	-	15,000	-	-
Turntables, water-crane	Switches, &c., for 112½ miles, at per mile 1,000 rupees	-	1,12,750	-	-
Bridge over the River Kurumnassa.	Similar to those over the Hullokur Keoul Rivers, 600 feet, at per foot 350 rupees	-	2,10,000	-	-
		-	87,30,196	13	1
	Add 10 per cent. for contingencies for 112½ Miles	-	8,73,010	11	1
		-			
	TOTAL for 112½ miles	- - - Co.'s Rs.	96,03,216	10	2
	Or per mile 85,172 Co.'s Rs.				

Note.—If, as I propose, a break in the line should be made at the River Soane until the increase of traffic may render the construction of a bridge advisable, it will be necessary to provide two stations, one on each side of the river, with engine-sheds, carriage-sheds, large 42 feet turntables for reversing the engines and tenders, and other accommodations peculiar to a terminus of a long line of railway, I assume each of these stations to cost 1,50,000 rupees:

	Rs.	s.	d.
For two stations at the Soane - - - - -	3,00,000	-	-
Ferry-boats, landing-piers, wood platform on the sand, and other arrangements for facilitating the traffic across the River Say -	1,50,000	-	-
	Co.'s Rs.	4,50,000	-

19 March 1853.

Geo. Turnbull.

ESTIMATE of the WORKS from Raj Ghat, opposite Benares, by Mirzapore, to the Right Bank of the River Jumna, at Allahabad, being a Distance of 92 Miles.

		<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Earthwork	10,000,000 cube feet rock cutting, at per 1,000 cube feet 10/	1,00,000				
	5,600,000, cube feet earth cutting, at per cube foot 4/	22,000				
	118,000,000 cube feet embankment, at per cube foot 4/4	4,72,000				
Brickwork	5,060,000 cube feet brickwork, at per 100 cube feet	-	22/	6,03,000	-	-
Ballast	2,787,840 cube feet, in 10 miles, of natural ballast, at per 100, 4/	1,11,512		11,13,200	-	-
	13,242,240 cube feet, in burnt clay, 6/	7,94,532				
Permanent way materials.	1,760 sleepers, each 3/	5,280		9,06,044	-	-
	3,620 chains, 35 tons, at per ton 80/	2,800				
	82 tons of fishes, at per ton 150/	1,275				
	129 tons of rails, assumed price:					
	Shipped in London	£. 10	s. d.			
	Freight to Calcutta	2	-			
	Carriage	1	-			
	£. 13	-	-			
	or <i>Rs.</i> 130	<i>Rs.</i> 16,770	-			
	3,620 keys, at per 1,000, 55/2	193	-			
	7,040 trenails, at per 1,000, 50/	362	-			
	Extra freight on 175 tons, at per ton, 10/8	1,887	8			
		28,607	-			
	92 miles.					
	8 add for station and sidings.					
	100 miles, at per <i>Co.'s Rs.</i> 28,507/8	-	-	<i>Rs.</i> 28,50,750		
	Laying Permanent Way:					
	100 miles, at per mile, 5,280 rupees	-	-	5,28,000		
Fencing gates at level	92 miles fencing, at per mile, 2,000 rupees	-	-	33,78,750	-	-
				1,84,000	-	-
Crossing stations	140 gates, at per gate	-	-	60/	8,400	-
	Raj Ghat (Benares)	-	-	<i>Rs.</i> 50,000		
	Ramnagpur	-	-	20,000		
	Clumar	-	-	40,000		
	Mirzapore, a large station with engine-sheds and workshops, as at Howrah	-	-	3,00,000		
	Two small road-side stations	-	-	80,000		
	Sirsa	-	-	20,000		
	Opposite Allahabad	-	-	50,000		
Turntables, water cranes	Switches, crossings, &c.			5,10,000	-	-
	92 miles, at per mile 1,000 rupees	-	-	92,000	-	-
Bridge over the Tons	Wrought-iron Superstructure, part on Cast-iron Cylinders and Part on Brick Piers:					
	12 wrought-iron girders, each 11,000 rupees	-	<i>Rs.</i> 1,32,000			
	7 cast-iron piers, containing 108 cylinders, weighing 935 tons, at per ton 160	-	1,49,600			
	396 cwt. wrought-iron screws, &c, in ditto, per cwt. 10/	-	3,960			
	Extra freight on 955, say	-	10,000			
Brickwork	76,800 cube feet of brickwork on piers, at per 100	-	22/	2,95,560	-	-
	130,000 cube feet in arching for flood-opening, at per	-	22/	16,896	-	-
Bridge over the Kurnowlee.	Similar to the above, 800, at per foot	-	250/	28,600	-	-
Bridge over the Belwan River.	Similar to the above., 858 feet, at	-	250/	2,00,000	-	-
				2,14,500	-	-
	Add 10 per cent. for contingencies	-	-	77,81,950	-	-
				7,78,195	-	-
	TOTAL for 92 Miles	-	-	<i>Co.'s Rs.</i> 85,60,145	-	-

From Messrs. *Hodgson, Concanen & Noyes* to the Most Noble the Marquis of *Dalhousie*, K. T., Governor-General of India, in Council, Calcutta.

5, Lincoln's-Inn Fields,
24 December 1852.

My Lord,

REFERRING to the statements which we had the honour of placing before the Governor-general of India in Council in the year 1845, on behalf of, and as the solicitors for, the Great North of India Railway Company, we have the honour to state, that the Upper India Railway is formed for the purpose of carrying out the objects of the Great North of India Railway Company, and is in part a substitution for that Company.

Understanding that the subject of railways in Upper India has been referred to your Lordship in Council by the Honourable the Board of Directors of the East India Company, we have, on behalf of the Upper India Railway, respectfully to beg of your Lordship in Council to give us an opportunity of stating the Company's case, before your Lordship in Council gives a decision on this most important subject.

We should add, that the Company has the active co-operation and support of Sir Herbert Maddock, late Deputy Governor of Bengal, and other eminent persons connected with India.

We have, &c.

(signed) *Hodgson, Concanen & Noyes.*

From *J. N. Campbell*, Esq., Chairman, to the Most Noble the Marquis of *Dalhousie*, K. T., Governor-General of India, in Council.

Upper India Railway Company, 2, Moorgate-street,
London, 8 January 1853.

My Lord,

By the last mail, Messrs. *Hodgson, Concanen & Noyes*, solicitors to this Company, had the honour of calling your Lordship's attention to the correspondence which they had conducted with the Government of India on behalf of the Great North of India Railway Company, so far back as the year 1845, and to the fact, that the Upper India Railway Company was founded for the purpose of carrying out the objects of the Great North of India Railway Company, and was, in fact, a substitution for that Company.

I have now, as the chairman of the Upper India Railway Company, to submit with every deference to the consideration of your Lordship in Council the following circumstances:

1st. That the line from Allahabad to Delhi was originally projected and brought before the authorities and the public by the Great North of India Railway Company; and that a memorial to this effect, founded on acknowledged facts and authentic documents, is now in course of preparation by Mr. Harry Borradaile, late chairman of that Company, for transmission to your Lordship in Council.

2d. That the Upper India Railway Company has received the support of the public in this country, and the active and cordial co-operation of many persons of influence connected with India.

3d. That the 3,000,000 of capital set apart for this country has been taken up by a highly respectable proprietary, who would have readily subscribed for a still larger amount; and that measures will be taken to have that portion of the capital reserved for India appropriated with as little delay as possible.

4th. That on the 25th of November last the following proposal was made to the Honourable East India Company, in a letter addressed to Mr. Secretary Melvill, by the managing Director, on behalf of the Upper India Railway Company; viz.

"To undertake the construction of its proposed railway on terms more moderate than those hitherto granted to any of the other three Companies to which the Honourable Court have extended their sanction and support, and I am now further instructed to state, that this Company is prepared to raise capital to construct, to the satisfaction of the Honourable Court, the section from Allahabad to Cawnpore, or, at the option of the Honourable Court, to carry the line on to Agra and Delhi, commencing operations simultaneously on as many points of the route as the Court may judge expedient, the Railway Company being bound to complete the line or sections agreed upon by a specified time, and for a specified sum."

I beg to call your Lordship's attention to the enclosed list of Directors and officers of the Company.

I have, &c.
(signed) *J. N. Campbell,*
Chairman.

The MEMORIAL of *Harry Borradaile*, late a Member of the Bombay Civil Service, to the Most Noble the Marquis of *Dalhousie*, K.T., Governor-General of India, in Council,

Respectfully sheweth,

THAT your memorialist, whilst a member of the said service, was deputed on special duty to Bengal, once as member of the Customs and Post-office Committee for all India, and again as member of the Indian Law Commission, and whilst so employed resided in Calcutta for a period of eight years and a half, and during that time had a favourable opportunity of making himself acquainted with the wants and resources of the Upper and Lower Provinces of Bengal.

That after your memorialist returned to England, the attention of the English public began to be turned towards the improvement of communication in India by the formation of railways in that country, and a Company was formed for the construction of a railway from Calcutta to Mirzapore, called "The East India Railway Company."

That about three months after that Company had issued its prospectus, another Company was established for the construction of a railway from Allahabad (where the river steam navigation ceases) to Delhi, under the title of "The Great North of India Railway Company," and of this Company your memorialist became a director, and subsequently chairman of the board of directors.

That sometime after the prospectus of the Great North of India Railway Company was issued, the East India Railway Company issued a new prospectus, taking up the line advocated by the Great North of India Railway Company, and asking their proprietary to raise the capital from four millions to ten millions, thus clearly showing that the line from Allahabad to Delhi, originally selected and brought before the public by the Great North of India Railway Company, had never been contemplated as part of the scheme of the East India Railway Company.

That, prior to any steps being taken by the projectors of the Great North of India Railway Company, they ascertained that no pledge whatever had been given or promise held out by the Honourable the East India Company to any company regarding the country proposed to be traversed by their projected railway, which fact was afterwards confirmed by official communications to your memorialist and his co-directors.

That the Great North of India Railway Company was repeatedly recognised by the Honourable the Court of Directors of the East India Company and the Government of India, and its managing committee was invited by the latter authority, on the 6th April 1846, to forward to the Home Department the draft of the provisions for a law for its incorporation.

That ultimately, from several causes, unnecessary to detail, but which were then principally produced by the unfavourable state of the money market in England, the Great North of India Railway was not further proceeded with, under the belief that more favourable circumstances might thereafter arise, and it was accordingly allowed to remain in abeyance.

That it was thus left apparently open to the East India Railway Company to obtain powers to construct the line of railway so projected by the Great North of India Railway Company; but the directors thereof found themselves unable to raise the requisite capital, or to conclude a contract with the East India Company for the construction of the said line.

That such failure of the East India Railway Company to effect anything for the good of Upper India, led again to the formation of a Company for constructing a railway from Allahabad to Delhi, and therefore under a new name the Great North of India Railway Company was resuscitated, and the Board of Directors thereof has been joined by several of the directors of that Company, and a large number of the shareholders therein have become shareholders in such resuscitated Company, and its affairs are conducted under the legal advice of the solicitors of the Great North of India Company, who have already had the

the honour of communicating with your Lordship in Council on behalf of your memorialist, and the Company he now represents.

That the Great North of India Railway Company was a fully registered company, with a capital of 4,000,000*l.*, and the present Company having raised its capital to the same amount, steps have been taken to introduce a Bill to Parliament, and application has been made to the East India Company for a grant of a concession to enable the carrying out of its objects.

That the Upper India Railway Company, having had the whole of that portion of its capital set apart for England readily subscribed for by highly influential parties, is in a position to carry out the original plans of the Great North of India Railway Company, if a grant be given to it on such terms as the Government of India may recommend the Home authorities to accord.

Your memorialist, and many others of the original shareholders of the Great North of India Railway Company, having merged their interests in the Upper India Railway Company, have resolved to come before your Lordship in Council, and to solicit your Lordship's favourable consideration, on account of their priority of claim for permission to form a line of railway from Allahabad to Delhi.

And your memorialist will ever pray, &c.

(signed) *H. Borradaile*, late Bengal C. S.,
Late Chairman of the

Upper India Railway Company, Great North of India Railway Company.
2, Moorgate-street, London,
24 January 1853.

No. 9.

From *J. P. Grant*, Esq., Secretary to the Government of India, to
Captain *T. E. Rogers*, Superintendent of Marine.

Sir,

Council Chamber, 12 April 1853.

I AM directed by the Governor-general in Council to transmit to you the accompanying copy of a despatch from the Honourable the Court of Directors in the Financial (Railway) Department, dated 16 February last, No. 3, and to request you will at your earliest convenience favour the Government with your opinion generally on the project therein disclosed.

Home Department.
Railway.

I have, &c.

(signed) *J. P. Grant*,
Secretary to the Government of India.

No. 1,861.

From Captain *T. E. Rogers*, Superintendent of Marine, to *J. P. Grant*, Esq.,
Secretary to the Government of India, Home Department.

Fort William, Marine Superintendent's Office,

Sir,

23 April 1853.

I HAVE the honour to acknowledge the receipt of your letter No. 9, of 12th instant, forwarding copy of a despatch from the Honourable the Court of Directors in the Financial (Railway) Department, dated 18 February last, No. 3, and requesting my opinion on the project therein disclosed.

2. The Honourable Court in the first para. of the despatch, adverting to the dangers that attend the navigation of the Hooghly between Calcutta and the river's mouth, suggest that these would, in a great measure, if not altogether, be avoided by connecting Diamond Harbour with Calcutta by a railway communication, and that such a work would in other respects be productive of much public benefit, and would materially promote the shipping and mercantile interests connected with this Presidency. It also appears to the Honourable Court that the establishment of docks at Diamond Harbour in connexion with the railway would be highly advantageous to the public.

3. With reference to the above, I beg to refer to the accompanying statement of total losses that have taken place between the outer floating light and Calcutta during the last 20 years of vessels entering and leaving the river, particularizing the place where each loss occurred: from this statement it will be seen, that the very great majority of losses, 42 out of 51, have taken place below

Diamond Harbour; I must also remark, that all the losses that have taken place above Diamond Harbour, as well as below, with one exception, have been in cases when the vessels have been proceeding without steam, or having driven from their anchors when not in tow. There is but one instance on record of a ship grounding in tow of a steamer having been lost, that of the Brig "Queen," below Diamond Harbour; and although seven ships have been lost on the James and Mary's and Fultah Sand (the only dangerous places above Diamond Harbour) within the last 20 years, the majority of these have been inferior ships. In fact, I believe that there is no instance of a really strong ship having been lost above Diamond Harbour. The Honourable Company's Steamer "Feroze" lay on the James and Mary's Sand for seven days, and was by the strength of the current driven through it into deep water, yet the hull of the vessel sustained no injury. The reason of the comparative safety of vessels that get on shore above Diamond Harbour is that the river being much more confined, there is no room for a swell to get up to cause the vessel to strain and make water.

4. The amount of registered tonnage arriving at and leaving Calcutta may be now taken at 4,000,000 tons each year, and it may be estimated that the ships land and take away 1,000,000 tons of cargo. A ship of 400 tons would therefore bring and take away 1,000 tons, which, if she is to remain at Diamond Harbour, must travel over to the rail: 1,000 rupees will on the average fully cover the expense of such a vessel for steam from Diamond Harbour to Calcutta and back. If therefore the rail can compete with the river in point of cheapness, goods must be conveyed to and from Calcutta at a cost not exceeding one rupee per ton. But if ships are to remain at Diamond Harbour and land their goods, then either docks or warehouses must be built, which would involve a further expense, as ships must either pay warehouse or dock line; the uncertainty of the river would interfere with the lading of the trains direct from the ships in the river.

5. It must also be remembered, that the generality of commanders of smaller classes of vessels live on board, but must be daily in communication with their agents, whose offices are in Calcutta. As there must be on an average 1,850 tons of cargo down and 1,450 tons up every day in the year, exclusive of Sundays, even with a double rail, trains other than cargo trains could not run many times during the day, and thus commanders would lose the benefit of frequent communication with their agents and their ships, which they now enjoy.

6. Diamond Harbour has hitherto been considered no less healthy than Calcutta; and, looking to all the drawbacks to remaining so far down the river, I believe that very few ships would stop there except it were made compulsory; in fact, I think it may be doubtful if any thing would be added to the safety of vessels by their remaining at Diamond Harbour. If docks were constructed there, the risk would not be great, although it would occasionally happen that ships would arrive at a time of day that they could not enter the docks, and thus be obliged to remain out for the night; and a southerly gale, which would not affect vessels at anchor at or near Calcutta, would wreck many riding at Diamond Harbour.

7. The idea has been started of a railroad from Calcutta to the Chilka Lake, below Pooree, and if the entrance to the lake could be deepened to 24 feet, which it is possible might be done by steam dredges, Calcutta might then have the benefit of the class of steamers of 6,000 tons, which it is said some parties are prepared to build. Chilka Lake itself is large enough to hold half the shipping in the world.

8. As long as the Hooghly is open, as at present, I do not think that the class of ships which now frequent the port would, after reaching Kedgerce, remain down the river, if they have the option of coming up. If, however, the Chilka Lake could be converted into a port connected with Calcutta by means of a railroad, ships of all classes would resort to it. Those approaching the head of the bay in the north-east monsoon would resort to it, because they would end their voyage a fortnight sooner than if they come on to Calcutta. In the south-west monsoon vessels would resort to the Chilka Lake Harbour, because they would on leaving that port be in a position to make a comparatively fair wind to any port to which they might be bound, and be at least one fortnight in advance of a ship leaving Calcutta at the same time.

I have, &c.
(signed) T. E. Rogers,
Superintendent of Marine.

STATEMENT of VESSELS LOST between the Outer Floating Light and Calcutta during the last Twenty Years.

NAMES OF VESSELS.	COMMANDERS.	Tonnage.	When Lost.	WHERE LOST.	P I L O T.
Ship Lord Amherst - -	J. Hicks - -	507	1833	Cowoolly - - -	T. M'Dormond.
" Brunswick - -	J. Palmer - -	380	"	New Anchorage - -	J. Sharling.
" Duke of York - -	R. Loeke - -	1,327	"	- - Hidgelee, blown on shore in a hurricane.	No Pilot.
" Lord of the Isles - -	G. Highton - -	392	1834	Jellingham Sand - -	E. Bartlett.
" Asia, F. - -	E. Heselton - -	418	1835	Diamond Sand - -	No Pilot.
" Fittle Main - -	Nacoda - -	"	"	Old Mud Point Channel	W. Birch.
" Windsor - -	W. Taylor - -	1,418	1836	Gasper Channel - -	J. Sharling.
" Asia - -	D. Forge - -	418	"	Saugor Point - -	T. M'Dormond.
Brig Highland Chief - -	J. Canning - -	181	1837	Long Sand - -	J. G. Davidson.
Ship Raj Rane - -	J. H. Harding - -	340	1838	Eastern Reef - -	T. Ghur.
Barque Sir Herbert Taylor	W. Poole - -	302	"	Off Silver Tree Pagoda	J. M. Hamilton.
Ship Protector - -	T. Buttonshaw - -	312	"	Eastern Reef Head - -	No Pilot.
Barque Equitable - -	R. Howlett - -	320	1839	*Fultah Reach - -	R. Arrowsmith.
Ship Francis Warden - -	Nacoda - -	401	1840	Auckland Channel - -	C. Jackson.
" Lady Stormont - -	T. F. Liddle - -	358	1841	Mud Point Ridge - -	G. F. Clarke.
Barque Water Lily - -	S. H. Pearce - -	150	"	S. E. Point of Saugor	W. Laing.
" William Barras - -	J. Norie - -	272	"	*Hospital Point - -	W. Laing.
Brig Symmetry - -	J. Lavill - -	250	1842	- - S. W. Point of Auckland Island.	J. Haydon.
Barque Globe - -	R. Stewart - -	438	"	Auckland Channel - -	J. B. Filby.
" Strathfeldany - -	T. G. Warren - -	476	"	Jellingham Sand - -	R. F. Barlow.
" Ricardo - -	J. L. Goble - -	353	"	*James and Marys - -	G. Moxon.
Brig Florville - -	W. Branthwaite - -	200	1843	*James and Marys - -	W. Bails.
Barque Adele - -	C. Rocoffort - -	356	"	Diamond Sand - -	C. Anderson.
" Victor and Felice - -	- - -	"	{ 1843 or 1844 }	Kedgerce Point - -	J. Hamond.
" Amoy - -	- - -	"	1844	Reef Head - -	No Pilot.
Schooner Columbine - -	J. Townsend - -	140	"	Saugor Sand - -	W. W. Laws.
Ship Camain - -	H. Barrett - -	388	"	Mizen Sand - -	W. Laing.
Barque Brilliant - -	H. King - -	338	"	Saugor Sand - -	C. A. Anderson.
Ship Marcombe - -	C. Dalatouehie - -	400	1845	Thornhill's Channel - -	J. Cleghorn.
" Arragon - -	G. Coffin - -	740	1846	Eastern Reef - -	No Pilot.
" Sandany - -	Nacoda - -	414	"	Saugor Sand - -	G. B. Smart.
Barque Carnatic - -	Ditto - -	575	"	Middleton Point - -	W. J. Etheridge.
" Dorothea - -	J. Harrison - -	305	1847	- - Lower part of Mud Point Channel.	T. E. Bond.
Ship Stalkurt - -	A. Gardner - -	560	"	Saugor Point - -	W. H. Harrison.
Brig Queen - -	N. Pike - -	180	"	Auckland Ridge - -	G. B. M'Kan.
Ship Mustapha - -	Nacoda - -	400	"	*Western Gut - -	D. Sandeman.
" Misor - -	Chaplin - -	622	1848	Reef Buoy - -	G. Spence.
Schooner High Flyer - -	T. Ansted - -	78	"	Lower part of Cowoolly Road	G. F. Atkinson.
Barque Helan - -	J. P. Biale - -	685	"	Near Calpee - -	J. Cleghorn.
Ship Cabras - -	Nacoda - -	390	1849	Saugor Sand - -	C. F. Harrison.
Barque Fadge - -	J. Mansfield - -	350	"	*Saygrall Sand Baboo Ghaut	C. E. Medley.
" Hamoodye - -	Nacoda - -	250	1850	Saugor Reach - -	G. Nooks.
" Ariadne - -	T. Goodair - -	501	"	Saugor Sand - -	W. H. Harrison.
Ship Phenomeno - -	A. A. Jansend - -	504	1851	Jellingham Sand - -	W. H. Gill.
" Gasper - -	- - -	"	"	*Ninand - -	R. Arrowsmith.
" John Leach - -	- - -	"	1852	Reef Head - -	No Pilot.
" Belle Isle - -	- - -	"	1848	Ditto - -	Ditto.
Schooner Brilliant - -	- - -	"	"	Cowoolly - -	Ditto.
Barque Homed Shaw - -	T. Hoffman - -	450	1853	*Fultah Sand - -	J. H. T. Full.
" Nizam - -	S. Jarmau - -	412	1852	*Sebgunge Sand - -	G. Collins.
" Parsee Merchant - -	N. Mayer - -	636	"	Eastern Reef - -	No Pilot.

* The places marked thus are above Diamond Harbour.

Fort William, Marine Superintendent's Office, }
23 April 1853.(signed) H. Howe,
Secretary.

(No. 1,000.)

From *R. M. Stephenson, Esq.*, Managing Director and Agent of the East Indian Railway Company, to Major *W. E. Baker*, Consulting Engineer to the Government of India, in the Railway Department.

Sir,

Calcutta, 10 March 1853.

I FEEL assured that you will concur in a suggestion which deserves the consideration of the Government at a period when new and important cities, towns and villages are about to be brought into existence upon the line of the railway, that before any buildings are erected, or any steps taken in that direction at the several railway stations, plans of the surrounding country shall be sent in, a valuation made of them, and a series of regulations framed for the observance of all who sell, let or purchase any of the land which may hereafter constitute a portion of the town, with a view to its being built upon sound sanitary principles of drainage, water supply and lighting.

The importance of early provision under this head is much greater than is generally recognised; and I confidently believe that if a little attention is bestowed upon it at the outset, the results will, in a very few years, become apparent and universally acknowledged.

It would be premature to enter more fully at present into the subject than to express the hope that you will deem it to be one of sufficient consequence to recommend the Government to provide against the consequences of disregarding it.

And I am, &c.

(signed) *R. M. Stephenson*,
Managing Director and Agent of the
East Indian Railway Company.

Submitted for the Orders of Government.

(signed) *W. E. Baker*, Major,
Consulting Engineer to the Government of India
in the Railway Department.

11 March 1853.

(No. 1,025.)

From *R. M. Stephenson, Esq.*, Managing Director and Agent of the East Indian Railway Company, to Major *W. C. Baker*, Consulting Engineer to the Government of India.

Sir,

Calcutta, 23 March 1853.

I ~~beg~~ permission to state, for your information, in considering the estimates recently submitted through you to the Government, that the Railway Company have uniformly preferred the less popular and usual practice of adopting a high scale of charges in estimating the probable cost of constructing their works, with a view to prevent possible disappointment afterwards, and as a more equitable course towards their proprietary than by assuming lower rates, which, from the numerous contingencies constantly arising, they might be unable to obtain.

In the detailed estimates now before the Government for the works below Allahabad, the mileage cost averages about 96,000 rupees, including all charges, and rolling stock for 682½ miles. The Railway Company contemplate works of the strongest, simplest and most substantial character, and would scarcely be justified in putting forward a lower calculation under the existing circumstances of the high price of iron and freight; but as the utmost economy consistent with strength and durability is the especial object to which attention is and should be directed, the Government may depend upon every possible exertion being made to keep down the actual cost.

The Government views are, and will be, so scrupulously observed in all respects by the Railway Company, that if it was desired to limit the cost to 50,000 rupees per mile (or even a less sum above Allahabad), it can be effected; but it would necessarily involve a diminution in the strength of the structure, which on a trunk line, with a known large traffic, would imply a questionable policy.

The

The Company desire only to carry out the wishes and intentions of the Government, whatever they may be, and in advising any especial course of action or expenditure, they do so only as a duty they owe to freely express their views, with the grounds on which they are based, and to act upon whatever decision the Government may come to upon the data submitted.

The preferable mode of duration is also a question upon which the Company are at all times ready to pursue any course which can be indicated as holding out any prospect of advantage and economy. The contract system, as hitherto applied to India, is by many regarded as a failure; but it is not generally known, that so far back as 1847, the Railway Company invited and held out every inducement to the principal English contractors to embark in these works; but the objections outweighed the inducements. The Company advised the adoption of the contract system for the first contracts, because the practice has been found most advantageous in Europe and America, and is regarded as the most perfect realization of the principle of the division of labour. The Company anticipated increased competition in all future contracts from new contractors who might be brought out, and from parties who had been engaged under the first contractors, and still hope to realize these expectations. If, however, the Government consider that the works can be carried out in part or wholly by the Company themselves, or by any other means more advantageously, the Railway Company will spare no exertions to give full effect to any suggestions having this object in view.

In the cost of the iron, a saving of above 10,000 rupees per mile may be effected by arrangements with the New Indian Iron Company for the early construction of the necessary blast furnaces, forges, mills and machinery to supply the whole of the wrought and cast-iron required during the ensuing seven years, at agreed prices, hereby securing a certain supply at a most reduced cost, and affording direct encouragement to an important branch of Indian trade.

I have, &c.
(signed) R. M. Stephenson,
Managing Director and Agent.

REMARKS by the Consulting Engineer.

24 March 1853.

IN my remarks dated 21st instant, I expressed an opinion that the estimates for a railway from Rajmahal to Allahabad are considerably too high, "not with any idea that the strength of constructions could be safely diminished, or its quality lowered," but because I believed, after careful examination of the estimates, that a railway on the scale adopted for the present section of the East Indian Railway could be, and would be executed on the line referred to at a lower rate.

The rate of 5,000*l.* per mile, assumed by Major Kennedy as generally applicable to India, is not, I think, sufficient for the Ganges Valley line, which, though favourable in many respects, will cross an extraordinary extent of still drainage and inundated land.

(signed) W. C. Baker, Major,
Consulting Engineer.

No. 106.

From the Chief Secretary to Government of Fort St. George to the Secretary to the Government of India.

Sir,

Fort St. George, 23 October 1852.

1. WITH reference to a despatch from the Honourable Court of Directors in the financial department, dated 18th August 1852, No. 13, I am desired to state, for the information of the Most Noble the Governor-general in Council, that Major Pears has been directed to report immediately the result of the survey of the Ghauts, and of the country between them and Menil, with the view of ascertaining the most favourable line of ascent from the plain to the Balaghaut, and that when this further report is submitted, application will be made to the

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Government

1852:
Home Cons. 22d
December No. 21.

Financial Department.

Government of India to determine the precise route which the railway at this Presidency is to take.

2. It is observed that by section 20, Act 20, of 1852, the provisions of Act 42, of 1850, for giving additional facilities for public works in Bengal, have been declared applicable to this Presidency, so that no further legislative enactment appears necessary to enable this Government to obtain land for the proposed railway, if, as is presumed, the Act has effect within the limits of Her Majesty's Supreme Court.

I have, &c.
(signed) *H. C. Montgomery,*
Chief Secretary.

No. 928.

1852:
Home Cons. 22d
December, No. 22.

From *A. R. Young, Esq.,* Under-Secretary to the Government of India, to
Sir H. C. Montgomery, Bart., Chief Secretary to the Government of Fort
St. George.

Home Department,
Railway.

Sir,

Fort William, 12 November 1852.

I AM directed to acknowledge the receipt of your letter, No. 106, dated the 23d ultimo, and to state that the Most Noble the Governor-general in Council awaits the promised communication from the Government of Madras regarding the route to be followed in the construction of a line of railway in that Presidency.

I have, &c.
(signed) *A. R. Young,*
Under-Secretary to the Government of India.

No. 66.

1852:
Home Cons. 22d
December, No. 23.

From *Sir H. C. Montgomery, Bart.,* Chief Secretary to the Government,
Fort St. George, to the Secretary to the Government of India.

Sir,

Fort St. George, 9 November 1852.

Public Depart-
ment.

WITH reference to my letter, No. 106, of the 23d ultimo, I am directed by the Right honourable the Governor in Council to forward, for submission to the Government of India, the accompanying printed copy of a report from Major Pears, the Railway Commissioner, communicating the result of his examination of the Ghauts in the neighbourhood of Vaniambady.

2. It will be seen that the lines proposed by Major Pears to be first constructed extend to nearly 260 miles in length, and consist of five parts; viz.—

1st. A trunk line to Menil	- - - -	48 miles.
2d. A branch to Vellore and Vaniambady	- - - -	70 "
3d. The trunk line continued to foot of the Ghauts	- - - -	53 "
4th. The Ghaut near Palmanair	- - - -	4 "
5th. From top of the Ghauts to Bangalore	- - - -	84 "
		259 "

3. The Governor in Council is of opinion, as formerly stated, that the chief trunk railway should run direct west from Madras to Menil, where it will divide into two original branches, one leading up the Ghaut, near Palmanair, and the other to Vaniambady: of these original branches, he considers that by Palmanair, and thence to Bangalore and Bellary, to be the most important in all points of view, though it may not at the very outset prove so profitable. He would, however, also strongly urge the formation, at an early date, of the second line by Vellore to Vaniambady, connecting the Southern and Western Provinces with this Presidency.

I have, &c.
(signed) *H. C. Montgomery,*
Chief Secretary.

From Major *T. T. Pears, c.b.*, Engineer, to the Chief Secretary to Government, Fort St. George.

Sir,

Madras, 27 October 1852.

1. In my report dated the 6th of July last, I stated my intention of proceeding to Kongoondy, and examining the Ghauts in the neighbourhood of Vaniembady : I have now the honour of reporting the result of that examination. Para. 30.

2. Having previously looked at the Ghauts between Toombah Droog (north of Palmanair) and Naikenary, and satisfied myself of the best locality for a pass within those limits, I have on this occasion made a general examination of that portion which lies between Naikenary and Sholegherry, and closely and carefully examined such portions as I judged, either from my own knowledge of the country, or from indications furnished by the maps, likely to offer facilities for the construction of a railway. Report 6th July.
Para 10.

3. Having completed this work, I passed on to Bangalore, and looked at a line, which appeared to promise favourably; from thence to Palmanair. On the sheet of the Indian atlas submitted herewith, the present high roads are marked by a red, the proposed lines of rail by a strong blue line.

4. The character of the Ghauts immediately south of Naikenary and Sallpet is very unfavourable to the passage of a railway; the height to be surmounted at this particular spot I take to be (with reference to other parts of the range) about a maximum. The table-land above is relatively high; the plain at the foot, bordering on the Vale of the Palmar, is relatively low; and the total difference of elevation between the top and bottom is from 900 to 1,000 feet. The Ghauts, as might be expected, display in this neighbourhood features on a large scale, and more formidable difficulties present themselves to a railway projector. It appears practicable, though not without very serious expense, to run a line (marked by a blue dotted line) up from the neighbourhood of Sallpet, by a valley (more open than the rest), at the head of which stands the village of Nunyalun; but though practicable, I see nothing else to recommend it in the present case.

5. From hence, proceeding southward, passing Amboor and Vaniembady, the Ghauts everywhere present an abrupt front. Near the latter place, indeed, as seen from below, they assume almost the appearance of a natural retaining wall, the face of which has been deeply furrowed by the fall of water from above. The village passes in this neighbourhood are exceedingly steep and stony; in all cases very difficult, in some impracticable, for pack cattle; dangerous even for a led horse.

6. In this portion of the Ghaut, the Palmar comes down on to the plain below : its course, not only where it passes down the Ghauts, but for several miles above (before it reaches their crest), is marked by steep and rocky hills, covered with thick jungle, giving no opening or encouragement whatever for a line of railway.

7. South Vaniembady, the Ghauts take a sweep round in a direction somewhat north of west, which they continue for about 25 or 30 miles. At or near this bend I find two places, in either of which it seems perfectly practicable to carry a line of railway; these have been marked in the accompanying map by a red and a yellow dotted line respectively.

8. Following on the line of Ghauts, I discover no favourable opening till beyond Kishnagherry, where, at or near a village now deserted, but marked "Kendody" on the maps, there appears to be considerable facilities upon two or three lines for carrying a railway up from the plain about Kishnagherry to the Mysore country. The general direction of these lines is indicated on the accompanying map by lines dotted black.

9. Between this point and Sholagherry the country becomes again very unfavourable; and the rugged belt of the Ghaut, which is in some places limited to three or four miles, here becomes much broader, the country being broken and hilly for a breadth varying from seven to ten miles. The pass near Sholagherry, by which the present high road ascends the Ghauts, is unfavourable for a railway.

10. It thus appears that between Naikenary and Sholagherry there are several points at which a railway might be carried up without serious difficulty; in only one of these, however, should I anticipate so good or so cheap a line as that which I have selected near Palmanair, while the whole of them are so far from the course of any of the proposed trunk lines as to place them out of the question for our present purpose. The day may come when some one of these may be taken advantage of for a branch line; but they would lead us too far out of our way now.

11. It will be observed, on a reference to my report of the 5th March 1851, para. 9, and the sketch which accompanied it, that in the completion of the principal trunk lines required in this Presidency, two passes up these Ghauts, and only two, would be required; one upon the line from Madras, towards the west and north-west (Bangalore and Bellary), the other upon a line passing up the middle of the peninsula, connecting its southern and central districts with Hyderabad, Nagpore and the north-west. For the first of these, the pass near Palmanair is in the best situation; for the other, it is probable that a way down the Ghauts may be discovered hereafter near Rutnagherry or Royacottah. Those near Vaniembady, which I have now described, are, it will be seen, far removed from either of these lines.

12. I have mentioned that only one of these passes would be likely to prove as good and cheap as that proposed near Palmanair; this one, which is marked on the map by a line dotted yellow, deserves more particular notice, were it only as offering a remarkably favourable line for a common road.

13. Although not shown on any of the maps that I have seen, there is at the present time, and has been for many years, a cart-road on this line, by which the produce of the Kongoondy zemindaree is brought down to Vaniembady. There is a tolerable road, over an easy country, from Coppum (six miles west of Kongoondy) to the top of the Ghaut, near the village of Sadainoor; from thence the descent is effected by a road running parallel to, and occasionally in the bed of a stream of no great magnitude, which passes down into the low country with an apparent uniform fall, the character of which is indicated by the fine sand which forms its bed throughout; in fact, there is a cleft in the Ghaut at this point through which the stream passes. This natural opening, so small as to be not distinguishable a short distance off, resembles otherwise the remarkable gap in the western Ghauts at Palghaut. The road, which, as far as I can see, is wholly a natural pass, presents from bottom to top one continued and uniformly easy slope, without in any single case the appearance of steepness or difficulty, and is at the present moment an easier pass for a loaded bandy than any that I have seen either on these or the western Ghauts. Had this been known before the adoption of the Sholagherry line, I cannot doubt but that the high road to Bangalore would have been carried by this route, the country being perfectly favourable the whole way, and the distance certainly not greater than by the present road.

14. It only remains for me to report, that my examination of the country between Bangalore and Palmanair has been very satisfactory. The line which seems to me the most eligible for a continuation of that from Madras to Palmanair is shown in the accompanying sheet of the atlas; it crosses in its course three distinct valleys, that of the Goriattum river near Palmanair, that of the Palaar, between Moolwagle and Colar, and that of the Pennure Keney, between the latter place and Bangalore. These valleys, with their intervening ridges, constitute the principal features on the line; but the whole country is made up of minor undulations, involving in the construction of a railroad a considerable amount of earthwork.

15. A general view of the Mysore country would produce an impression of difficulty in the way of railway work, in consequence of the frequent appearance of surface rock; but the character of the country varies much; and while in some places the undulations appear to consist of nothing but solid rock, in others clay or loam is found to overlie the rock to a very great depth; and the line which I have now looked at appears very favourable in this respect. I should expect an average depth of earthwork of eight or ten feet to give gradients nowhere exceeding 25 feet in the mile. Bangalore is about 900 feet
above

above Palmanair, the distance on the proposed line 80 miles, the average rise, therefore, 11 feet in the mile, but the greater part of the rise is effected upon the first 30 miles from Palmanair.

16. It may be well to refer again briefly to the question of the proper direction for the first line of railway; in doing so, it may save trouble if I recapitulate some statements and opinions that have been already given by myself and other officers.

17. With a former report I submitted a sketch, showing the general direction of the lines which would probably be considered of the first importance within the limits of this Presidency; and presuming that the scheme there proposed is approved, it would now appear merely a question of time which line shall be constructed first. 5th March 1851.
Para. 9.

18. The two most important of those lines, that from Bellary and that from Vaniembady and Salem, are shown to form a junction within 50 or 60 miles of Madras, and thence to follow one trunk line.

19. There can be, I presume, no doubt as to this trunk line.

20. The question then arises whether from that point the line shall be carried on by Palmanair to Bangalore and Bellary; whether we should first construct that to Vaniembady, or whether we should do both as soon as possible.

21. The Honourable Court of Directors, in their despatch to the Supreme Government in the Financial Department, No. 17, of 1851, dated 12th of March, desired that it should be explained that the survey of this line should have reference not to an experimental portion only, but to the ulterior destination of such a mode of conveyance as forming part of a general system; the object of which would be to facilitate communication for political as well as commercial purposes, and to effect more ready intercourse with other Presidencies.

22. In a former report I gave my opinion that the most important line, as far as the interests of the country or Government are concerned, was that from Madras to or towards Bellary, having in view ultimate connexion with the Bombay railways; but I added that, as an experimental line, it did not hold out such good promise of immediate results as one of less ultimate importance, viz., that to Vaniembady. 5th March 1851.
Para. 57.

23. Mr. Bourdillon, in his report to Government, gives it as his opinion that we should begin with one complete line to the centre of the peninsula, as, for instance, Bellary or Bangalore, and subsequently, if this complete line is not to be undertaken, proposes a line to Mooglee (in the direction above recommended), and a branch to Vellore or Vaniembady. 4th July 1851.
Para. 3.
Para. 15.

24. Major Cotton writes strongly in favour of the direction of Bellary. Report 12th July
1851. Para. 9.

25. At the time these several reports were made, the mode, as well as the particular place, by which the Ghauts might be surmounted, were altogether undetermined: having now ascertained that a pass, perfectly practicable for locomotive engines, may be made near Palmanair, and that the approach through North Arcot to that pass can be made at much less cost than would have been anticipated, from the known character of that district; additional weight is given to the arguments in favour of the Bangalore and Bellary line.

26. As, however, I observed before, it is a mere question of which shall be done first, and it is perhaps of no great importance which is first taken in hand, since there can be no doubt of a rapid extension of the railway system when a beginning has once been made.

27. The capital raised by the Madras Railway Company amounts to 500,000 £., and I believe that sum laid down towards Vaniembady would meet with an earlier and better return than the same taken in the direction of Palmanair and Bangalore or Bellary: not only because that road is better fed by the high-ways of the country as they at present exist, but because, lying over a very favourable country, its construction would be cheaper: in other words, the same amount of capital would make a longer railway.

28. On the other hand, I am satisfied that the line to Bangalore and Bellary would be of far greater ultimate value to the country, as it is of much higher importance to the Government; and seeing that the Government has undertaken to secure to the Company a liberal interest on their capital, there can be no doubt as to its right to determine the direction of the line, and, in so doing, to consult its own interests and those of the people of the country.

29. The reasons, then, in favour of the Vaniembady line, are the cheapness of construction, and the traffic now existing upon it.

30. The extent and fertility of the two districts, Mysore and Bellary, their distance from the coast, the importance of the military stations, the peculiar nature of the chief agricultural product of Bellary and the neighbouring district of Cuddapah, viz., cotton, the circumstance that such a line would tend directly to a connexion with the western Presidency, all pleads strongly in favour of the Palmanair line.

31. The traffic from the Mysore country towards Madras at present is not great, and is, I apprehend, overestimated by many, as it has been by Mr. Bourdillon, in his letter to Government of the 4th July 1851; but, possessing a fine climate, enjoying periodical rains, which rarely, if ever, fail, extensively irrigated by an immense number of tanks, there is sufficient evidence of this traffic being susceptible of large increase in sugar, sooparee, coffee, cotton, silk, wool, &c., while the peculiar character of its climate is further shown in the extensive cultivation of potatoes among the natives, and that of other foreign fruits and vegetables among European residents, the export of which to the coast and the districts below the Ghauts, appears only limited by the present imperfect means of transport.

32. Having thus determined the best pass up the Ghauts, and considered the relative claims and merits of the principal lines proposed, I conclude that the best mode in which the Railway Company could commence operations would be by undertaking the line to Palmanair and Bangalore, with a branch to Vellore and Vaniembady; and that the branch should take off from Menil.

33. Upon this latter point it is necessary that I should offer a few words of explanation. In an extract from Minutes of Consultation in the Public Department, No. 35, dated 12th January 1852, para. 7, I was instructed to "study to carry the trunk-road as far forward as it can conveniently serve in common for a line in that direction, as well as for one by Vellore to Vaniembady." In carrying out these instructions, I expected to run it, or nearly, to the Poincy river, *i. e.*, about 65 miles from Madras.

34. I find, however, that after Menil (48 miles from Madras) that line rapidly steepens, and within a few miles assumes quite a different character in regard to gradients. If, therefore, the trunk line were carried beyond Menil, and near the river, the communication between Madras and Vellore would be broken at that one place by some stiff gradients, which would rule the whole line, and prove very prejudicial; whereas if the branch were made from Menil, the whole line from Madras even to Vaniembady would be homogeneous, characterized by gradients not exceeding 16 or 18 feet in the mile.

35. This is an important consideration, as affecting most materially the economical working of the line.

36. It may be said, however, that by thus striking off at the 48th, instead of the 60th mile, we render necessary the construction of 12 more miles of rail; were this the case, the country being remarkably favourable, I should consider it money well spent in preserving the cheap, workable character of the entire line; but, in fact, it is likely to prove otherwise; as I apprehend that, before long, the trunk line, and that alone, whether it is 48 or 60 miles, will have to be laid double, while single lines will for many years to come suffice for the others.

The line branching from Menil would sink rather to the south, to avoid the Nelacontria cluster of hills, and would so pass at Annmoor, within four miles of Arcot and Wallajahmuggur.

37. It is of great importance to the economical and successful working of a railway, that the character, as well as the extent, of the line, or of any particular section

Para. 14.
Suppose 2¹/₂ of that
quantity to come
from Bangalore
and Mysore.

section of it, should admit of a locomotive engine doing a fair day's work, at its full, or nearly its full power. To insure this, it is not only necessary that there should be sufficient length for it to work upon, but that there should be sufficient length for it to work upon; * but that there should be no ruling gradient, such as to compel the engine to run under-weighted during the greater portion of the line.

* Sic in orig.

38. For example, if the line which I propose as far as Menil, with gradients never exceeding 17 feet in a mile, were broken about midway, by one of 20 or 25 feet, on a length of one mile, it is evident that, to meet this, the engines must travel throughout the whole of the remaining 47 miles under-weighted.

39. I conceive that the lines which I now propose as a commencement, would work very economically; they would consist of five parts—

	Miles.
1st. A trunk line to Menil - - - -	48
2d. A branch to Vellore and Vaniembady - -	70
3d. The trunk line continued to foot of the Ghaut -	53
4th. The Ghaut near Palmanair - - - -	4
5th. From top of the Ghaut to Bangalore - - -	84
Miles - - - -	259

40. In working the first of these (the trunk line to Menil) it would be necessary to provide power to convey the whole of the traffic island† from Madras. The gradients not exceeding 17 feet in the mile, engines of moderate power would do this. The second (the branch to Vellore and Vaniembady) would receive only a portion of the above traffic, and the gradients remaining equally favourable, a much lighter engine might be substituted, and would have fair work in running to Vaniembady. On the third portion (the trunk line continued to the foot of the Ghaut) the average rise is greater, and the gradients are consequently steeper, viz. 25 or 30 feet in the mile; but the same engine which carried a train of 80 or 100 tons (gross) from Madras to Menil, would carry up these steeper gradients that train reduced by the waggons turned off towards Vellore. The engine would thus find a good day's work in running from Madras to the bottom of the Ghaut, being 101 miles.

† Sic in orig.

For the fourth portion (the Ghaut itself) an engine of special construction, of greater power and less speed, must be provided.

The 5th portion, being 84 miles from the top of the Ghaut to Bangalore, would require an engine similar to those used below the Ghauts.

41. The lines above proposed for first construction amount to nearly 260 miles in length. Taking the cost of construction and stocking at an average of 40,000 rupees per mile, would give the total capital required 1,04,00,000 rupees, or something more than 1,000,000 sterling. The interest on this, at 4½ per cent., amounts to 4,68,000 rupees, which, if we take the working expenses at 50 per cent., on the receipts, would require an annual mileage of 57,600 tons upon the whole extent of way, or traffic of various kinds equivalent to it.

42. I have already shown that the traffic between Madras and Wallajahmuggur may be even now taken, on a very reasonable estimate, at 50,000 tons of goods, besides parcels and passengers; and when I think of the vast influence the lines now proposed would exercise upon some of the finest districts in southern India, the impulse they would give to education and commerce, of their importance also in a political point of view, I cannot doubt either of the success of the work as a speculation, or of the great and lasting benefits it is calculated to confer on all classes of people in this part of India.

Report, March 5th, 1851. Para. 29.

I have, &c.
(signed) T. T. Pears,
Railway Commissioner.

P. S.—I beg to state, that the survey of the line to Palmanair has been, after many hindrances, arising from the sickness of the surveyors, and the frequent rains, at length completed, and the drawings are now in course of execution.

The levels, which have been much delayed from similar causes, are also near completion; and I trust in a few days to be in possession of all the necessary data for the preparation of the estimate.

(signed) *T. T. Pears,*
Railway Commissioner.

From Major *T. T. Pears*, C.B., Engineers, to the Chief Secretary to Government, Fort St. George.

Sir,

Poiney, 15 December 1851.

1. With reference to an extract from Minutes of Consultation, No. 812, in the Public Department, dated 29 August 1851, I have now the honour to forward, for submission to the Right Honourable Governor in Council, a survey and estimate,* of the first 48 miles of a proposed trunk line of a railway running westward from Madras as far as Menil.

* Rs. 17,69,693. 3.

2. In my report of the 4th July last I recommended that, should the Government desire, without any special reference to the town of Wallajah-nugger, to lay down the best trunk line westward, the line marked No. 2 (and shown in the map which accompanied that report) should be adopted, and carried out as far as Menil, leaving the question of its prolongation thenceforward, whether by Ammoor or Sholinghur, to depend upon the determination of the best pass up the Ghauts.

3. The survey and estimate now submitted, have been framed for a single line of railway as far as Menil, 48 miles 5 furlongs from Madras: a further survey from Menil to the top of the Ghauts will be submitted as soon as I have ascertained in a satisfactory manner the best point and mode of ascent for a railway.

4. The line, if carried to Menil, as now proposed, would start from the canal basin, near the north-west corner of Black Town, pass near the villages of Peramboor, Coratoor, Avady and Thodoor, and cross the present high road (by Naggery) to Cuddapah, at a point about four miles south-east of Trivalloor. Skirting the northern bank of the Coomu, it then crosses the valley of the Coortilliar; ascending from which, it reaches, at Moshoor, the high ground which forms the water-shed between the Coortilliar and the Tritany rivers, which elevated ridge continues to offer a most convenient line for a railway, until it reaches the broken and hilly country between Sholinghur and the Poiney river.

5. This line offers no difficulties of any kind. The earthwork is light, the soil generally favourable. The total amount of earthwork in 48 miles and five furlongs is—

						Yards.
Embankment†	-	-	-	-	-	793,495
Cutting	-	-	-	-	-	362,364

TOTAL - - - 1,155,859 cubic yards.

or 23,822 cubic yards per mile. This is nearly the same as that found on the line to Wallajah-nugger, reported on by me on the 4th July last; but the country on this line is, nevertheless, much more favourable, and the earthwork has been brought to nearly the same amount, in consequence of my having adopted much better gradients in this case.

6. By the table of gradients (A), it will be seen that the steepest is only 1 in 309, and that the character of the country has admitted of my carrying the line from Madras to Menil (rising in the aggregate 360 feet) with only three counterslopes; of which, one may be considered to all practical purposes level, and the other two might be got rid of at the expense of a little heavier earth-work.

7. The tanks through which the line has been carried are in almost all cases shallow enough to admit of the road being lifted above the highest water, without

† Appendix B.

without much embankment. In some instances I allow for cutting off a portion of the tank, by an addition to the bank.

8. I would observe here, that the line shown in the accompanying survey has been laid down for the purpose of measurement and estimate, and as showing the probable general course for a railway.

9. It has been attempted as much as possible to avoid encroaching on the villages themselves, and the deeper portions of the most important tanks; but in laying down the line hereafter, it will probably be found both practicable and expedient to deviate in some places from that followed in the survey, and to cut through villages occasionally, where the character of the line is likely to be prejudiced, by an attempt to pass clear of them; some such probable deviations are shown by dotted lines on the survey. These will only affect the estimate as shortening, and therefore cheapening it on the one hand, while something more might be required in compensation for lands and houses.

10. The works of masonry are of the commonest and most trifling description, with the one exception of the bridge over the Coortilliar. Appendix C.

11. I recommend here a work of sufficient length to span the entire bed, and afford ample space with the least possible headway. I would propose, therefore, a bridge of 30 vents, of 30 feet each, with abutments and piers of brick and chunam, and iron or teak girders for the support of the road; which of these materials shall be used is a question of economy, to be determined upon inquiring into the probable cost of each. The construction of such a bridge is a work of the simplest kind; and, for a single line of rails the sum I have allowed, viz. 50,000 rupees, will I doubt not, be found ample. In the statement of bridges and drains, will be found a great number of irrigation channels. I have allowed, I believe, very liberally for these, both as to the number and individual cost.

12. The permanent way has been calculated on my former data; and I have entered in the present estimate the same relative amount (considering the different lengths of the two lines), for building and rolling-stock, and contingencies. This I have done in order that a comparison may be readily made between the total cost per mile on the Menil line and that shown upon the former survey, not as considering Menil a desirable terminus, or with any view of representing the line carried up to that point as a complete work. Appendix D.

13. A comparison between the two estimates shows the following results:

Amount of Earthwork per Mile :						Cubic Yards.
Wallajahnuggur line	-	-	-	-	-	24,342
Menil	-	-	-	-	-	23,822
Cost of Earthwork per Mile :						Rupees.
Wallajahnuggur line	-	-	-	-	-	2,300
Menil	-	-	-	-	-	1,820
Cost of Bridges and Drains per Mile :						
Wallajahnuggur line	-	-	-	-	-	1,568
Menil	-	-	-	-	-	1,530
Total Cost per Mile, including Stock :						
Wallajahnuggur line	-	-	-	-	-	36,730
Menil	-	-	-	-	-	36,488

14. It will be seen, that though the amount of earthwork per mile is nearly the same, the cost differs. This arises from the actual depth of cutting and embankment being less on the Menil than on the other line.

15. The value and extent of land through which the line passes, are shown in the following statement :

Nunjah	-	-	-	-	-	24,861 yards.
Punjah	-	-	-	-	-	12,410 "
Manium	-	-	-	-	-	1,636 "
Jope	-	-	-	-	-	520 "
Garden	-	-	-	-	-	133½ "
Waste	-	-	-	-	-	45,922½ "

Assuming, as in my former estimate, 25 yards as the average breadth of land required, the following would be the superficial extent of land of each kind taken for the work :

Nunjah	-	-	-	-	-	97,066	cawnies.
Punjah	-	-	-	-	-	48,476	"
Manium	-	-	-	-	-	6,390	"
Jope	-	-	-	-	-	2,033	"
Garden	-	-	-	-	-	0,520	"
Waste	-	-	-	-	-	179,657	"

The estimated full value of the above, at the rates before assumed, would be as follows :

Nature of Land.		Rate.		Total Value.	
		Rupees.		Rupees.	
Nunjah, at per cawnie	-	175	-	16,986	
Punjah - ditto	-	50	-	2,423	
Manium - ditto	-	175	-	1,118	
Jope - ditto	-	100	-	203	
Garden - ditto	-	175	-	90	
Waste	-	-	-	-	
TOTAL Value of Land				-	Rs. 20,820

or about 428 rupees per mile.

I cannot pretend to great accuracy in this calculation ; but I have attempted to allow sufficient for the full and absolute value of the land and its probable cost to the railway, including the Government claim upon it, as well as the purchase of the tenant right ; the latter being a very variable quantity, and very difficult to ascertain satisfactorily.

17. I have not considered it necessary to enter again upon the subject of the traffic, the working expenses and profits. The statements and calculations, submitted with my report of the 5th March 1851, will apply with equal force to any line running from Madras westward, and monopolizing all the traffic between that port and the central districts of the Peninsula, Bellary, Cuddapah, Mysore, Salem and North Arcot.

18. The gradients on the line by Menil being of a much better character than those on the Wallajahnuggur line, the working expenses would, of course, be proportionably lighter ; so far, therefore, in an estimate of profits this line would have the advantage.

19. The circumstance alluded to in the 60th para. of my report of 5th March 1851 respecting the fall of the line being with the bulk of the traffic, is strikingly illustrated by the section now submitted. There will be seen an almost unbroken and steady fall from west to east, along the whole 48 miles. Since in the total estimated traffic on this line the amount running towards the east is to the return traffic nearly as 10 to 7, the above constitutes a very favourable feature in the working prospects of the line.

20. The extension of the line from Menil to whatever point may, in the first instance, be selected as a terminus, whether Vellore, Vaniembady, Gorriattum or Palmanair, will be effected under circumstances more or less favourable, according to the result of that selection, and to the direction taken for a pass up the Ghauts ; but it is to be observed, that whatever may be the result of the deliberations on the above points, the extension from Menil will be made under at least as favourable circumstances as it would be on the Wallajahnuggur line.

21. If, for example, the result of my present examination of the Ghauts should lead to the adoption of the line of the Palaar for the trunk line, the run from Menil to Vellore, by Ammoor, would lie across a most favourable country. If, on the other hand, it is determined to carry the line through North Arcot, to or near to Palmanair, the position of Menil is much more favourable for such an extension than Wallajahnuggur would be. In this case, our course would be

by Quodekel (near Sholinghur), to some convenient point near the left bank of the Poiney; from whence divergent lines might be carried to Palmanair on the one hand, Vellore and Vaniembay on the other.

22. Under any circumstances, therefore, this line to Menil appears the best for a trunk line.

23. In recommending this project to the most favourable consideration on the part of Government, I would briefly remark on the many circumstances that conspire to prompt and encourage an undertaking of this nature in this part of the country, and at this juncture.

24. The character of the country is most favourable; labour is cheap and abundant; there are no costly or difficult works required: for viaducts, simple embankments; for bridges, unpretending structures of brick and chunam; as they are the simplest, so they are the cheapest works we could construct for the purpose. We have no navigable rivers, and none that are not dry, or nearly so, during a great part of the year. We are at liberty, therefore to apply works of the cheapest and plainest description, in carrying a railroad across them, laying the foundations, and raising the piers on dry beds.

25. The greater part of the land is of small value; much of it of no value at all, and not likely for many years to be turned to so profitable an account as in carrying a railway.

26. Iron also is, or was very lately, cheaper in England than it has been for many years*—I believe I may say than it ever was before: we may reasonably doubt whether it will long remain at so low a figure; at all events, the proportion which in the Madras Railway the rails would bear to the whole cost, renders this circumstance one of great importance, and deserving of early consideration.

27. In this part of the country the railway, carried at once far enough towards the interior, would literally meet with no competition. There are no canals, and but few good roads.

28. It is obvious, therefore, that this line would commence operations under peculiarly favourable circumstances: it would not only monopolize the entire traffic proper to the direction it takes, but, from its great superiority over other existing modes of transport, would attract largely from all directions, and would have the vast resources of this country, hitherto but partially developed, to draw upon for an increase in the amount of traffic. I shall not, to prove the probability of such increase taking place, trouble Government with arguments familiar to all, and drawn from the examples of rails in Europe; but merely observe, if the increase in traffic in England, where the rails had to contend with a very perfect system of transport, has been in every case large beyond all expectation, we are entitled to assume that under our circumstances such increase would take place in a much higher ratio. We advance at once from roads of an inferior description, pack cattle and bullock bandies, to the locomotive engine and its train of waggons.

29. The proposal to lay down this line of railway has excited much interest among the natives, with many of whom I have conversed on the subject. The benefits that would arise from such a work are fully understood, and are readily acknowledged: the effect upon the people produced by one such work in operation, would be very beneficial, while the Government would have, in the experience gained in its construction, as well as the commercial and social statistics furnished in the course of its working, a good basis for their deliberations on further similar projects.

30. Among the advantages possessed by us here, must not be forgotten the cheapness of labour of almost every kind, as required in the management of a railway.

31. With the exception of one department (the drivers), which must at the outset be supplied entirely from England, the heads of departments would alone be

* I learn from the public papers, that tenders have been made to deliver rails at Alexandria for the Egyptian railway at 5*l.* and 5*l.* 2*s.* 6*d.* per ton.

be required from home. With a few good mechanics, and plate-layers as instructors, the Indoo Britons and Natives would be found well fitted for any and every duty connected with a railway. Active, steady, intelligent men, as Lascars (porters) or policemen may be had for 6 or 7 rupees a month; common labourers to assist in the repairs of the way and works will be well paid with 5 rupees per month, and for this sum a class of men not easily surpassed in activity or natural intelligence, in the quick eye and steady hand, may be obtained to an almost unlimited extent in the Madras Cooly. I doubt not that the arsenal of Fort St. George and the gun-carriage manufactory will show a number of men of these classes quick to learn and ready to perform any duties (not involving actual mechanical skill), required of them in the various departments of a railway.

32. Higher pay would, of course, be required for mechanics; but of those, too, there would be no want. The extended field offered by a railway department would affect not only the number, but the character and qualifications of the mechanics of Madras, and the supply would, I have no doubt, keep pace with the demand.

33. The railway offers, indeed, a gratifying prospect of useful and honourable occupation to the members of the Indo-British community; while that community, on the other hand, presents itself at once as the source to which we may confidently look for valuable public servants in every department.

34. In conclusion, I take this opportunity of reporting, that my examination of the Ghauts, as far as it has yet been carried, has proved much more satisfactory than I had anticipated.

35. I am not yet prepared to pronounce decisively either upon the best line or the best mode of ascending them; but I am satisfied that the passage up can be effected with little difficulty. We shall, I believe, require no works of serious cost or magnitude—no tunnels—but shall probably run the rail by an incline perfectly practicable for locomotives of special construction the whole way up from the plain below to the general level of the Balaghat.

36. I have arrived at this conclusion, from a partial examination of the Ghauts in this neighbourhood; and although the most favourable line for ascending the Ghauts may not prove the most favourable for approach to them, I am very sanguine that the difficulty will be got over at much less cost than has been generally anticipated.

37. Should the Government determine on sanctioning this line of railway, I would recommend that attention be given to the completion of the first 24½ miles from Madras to a station near Trivalloor (and Tripasoor), and opening that portion as soon as possible. There would be found a considerable passenger traffic so far in connexion with Trivalloor, Tripatty and Cuddapah; and, besides the local traffic in fire-wood and ordinary agricultural produce, the contemplated improvement in the Naggery line of road would probably throw an increased amount of goods traffic upon the rail at that point.

38. This first section of the line falls short of the Coorsilliar river, and the works would consist merely of earthwork, and small works of masonry.

39. The line might subsequently be opened as far as Menil; to which point, by making some improvements on the present country roads, traffic now taking the Wallajahnuggur road (or a great portion of it) might be drawn, until such further extension of the line took place as should take up that traffic completely at Vellore, or other approved terminus.

40. It will be observed, that though the outlay upon 60 or 100 miles of railroad at 36,488 rupees per mile is large, the actual sum expended upon the works, earth and masonry, is comparatively small; and, consequently, the demand for labour is not likely to be large enough to create any embarrassment, or to enhance in any degree its cost. The earthwork, for example, amounts to about 1,160,000 cubic yards; which, assuming the small amount of two yards per diem for each man, would require less than 200 men for its completion in 300 days. I have been lately engaged in collecting information upon the capabilities of the neighbouring districts in regard to the supply of labour and material;

material; but there can be no doubt of a far greater amount of labour than this being available, if required, in the districts through which this line would pass, or in those adjacent. It may be as well, however, to observe, that the cost of a work of this nature, if executed by Government, might be somewhat reduced by a judicious employment of convicts, the larger buildings ultimately required at the principal stations being at once built for their shelter and security. The services of a company of Sappers would be of the greatest importance; I should employ them on this, as on all similar occasions, entirely as artisans or superintendents: if not well qualified for such duties (as I believe most of them now are) their employment upon any public work in an inferior capacity appears to me waste of money.

41. I should anticipate great advantage from their services, not only from their skill in various handicrafts, as carpenters, chucklers, brick and tile makers, &c., rendering us, in a great measure, independent of any possible temporary strike among the daily labourers of these classes, but also from their characteristic intelligence, general usefulness, and, perhaps more than all, from the means afforded us of introducing, through their agency, order and regularity into the management of large bodies of workmen, a point which is of the utmost importance in the conduct of large works; and one in which, unfortunately, the ordinary native superintendents very generally and entirely fail.

The honour of taking a leading part in the construction of the first railway in Southern India is not only well deserved, but would, I doubt not, be fully appreciated by that distinguished body of men.

I have, &c.

(signed) T. T. Pears,
Major Engineers.

ABSTRACT STATEMENT of the probable Cost of constructing and stocking a single
Line of Railway between *Madras* and *Menil*.

NATURE OF WORK.										AMOUNT.		
										<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Earthwork	{	Embankment	-	-	-	-	-	-	-	57,633	7	-
	{	Cutting	-	-	-	-	-	-	-	30,321	1	-
Stone facings	-	-	-	-	-	-	-	-	-	7,170	-	-
Side drains	-	-	-	-	-	-	-	-	-	16,444	11	-
Foot bridges	-	-	-	-	-	-	-	-	-	31,000	-	-
Level crossings	-	-	-	-	-	-	-	-	-	4,800	-	-
Bridges and drains	-	-	-	-	-	-	-	-	-	74,213	-	-
Catch drains	-	-	-	-	-	-	-	-	-	1,200	-	-
Fencing, inclusive of 1,100 yards wall	-	-	-	-	-	-	-	-	-	5,700	-	-
Permanent way	-	-	-	-	-	-	-	-	-	9,50,000	-	-
Rolling stock	-	-	-	-	-	-	-	-	-	2,20,000	-	-
Water tanks	-	-	-	-	-	-	-	-	-	5,000	-	-
Switches, crossings, guard-rails, &c.	-	-	-	-	-	-	-	-	-	3,200	-	-
Buildings and stations	-	-	-	-	-	-	-	-	-	1,20,000	-	-
Turntables, travelling platforms, and rails for ditto	-	-	-	-	-	-	-	-	-	8,000	-	-
Furniture, fittings, tools	-	-	-	-	-	-	-	-	-	40,000	-	-
Superintendence	-	-	-	-	-	-	-	-	-	1,15,000	-	-
Contingencies	-	-	-	-	-	-	-	-	-	80,000	-	-
TOTAL - - - <i>Rs.</i>										17,69,693	3	-

(signed) *T. T. Pears.*

Appendix (A.)

TABLE OF PLANES on the proposed Line of Railroad from *Madras to Menil.*

Number of Planes.	Length in Yards.	Rate of Inclination.		Number of Planes.	Length in Yards.	Rate of Inclination.	
		Rise.	Fall.			Rise.	Fall.
1	1,200 $\frac{1}{2}$	- level.		23	2,020	1 in 953	
2	803 $\frac{1}{2}$	1 in 942		24	2,624 $\frac{1}{2}$	- level.	
3	3,427 $\frac{1}{2}$	1 in 551		25	1,055 $\frac{2}{3}$	1 in 1,019	
4	885 $\frac{2}{3}$	- level.		26	600	1 in 1,201	
5	658 $\frac{1}{2}$	1 in 1,795		27	4,400	1 in 590	
6	933 $\frac{1}{2}$	1 in 453		28	880	1 in 606	
7	1,483 $\frac{1}{2}$	1 in 3,134		29	2,420	- - -	1 in 6,482
8	1,488 $\frac{2}{3}$	1 in 744		30	2,640	1 in 2,010	
9	1,313 $\frac{1}{2}$	1 in 24,825		31	1,702	1 in 622	
10	2,272 $\frac{1}{2}$	1 in 643		32	276	1 in 4,140	
11	140	- level.		33	1,777	1 in 26,655	
12	1,001 $\frac{1}{2}$	- - -	1 in 673	34	911 $\frac{2}{3}$	1 in 882	
13	348 $\frac{2}{3}$	- level.		35	2,703	1 in 637	
14	2,377 $\frac{2}{3}$	1 in 430		36	498	1 in 4,980	
15	2,600	1 in 407		37	5,332	1 in 11,076	
16	880	- level.		38	1,540	1 in 658	
17	2,420	1 in 395		39	1,405	1 in 493	
18	352 $\frac{1}{2}$	- level.		40	15,035	1 in 309	
19	980	- - -	1 in 479	41	880	1 in 10,560	
20	1,426 $\frac{2}{3}$	1 in 965		42	2,640	1 in 387	
21	1,200	1 in 8,780		43	3,933 $\frac{1}{2}$	1 in 10,260	
22	880	1 in 596					

(signed) T. T. Pears.

Appendix (B.)

ESTIMATE of the probable COST of EARTHWORK, DRAINS, BRIDGES, &c.,

Number of Miles.	Description of Soil.	EMBANKMENT.					CUTTING.				
		Length in Yards.	Cubical Content in Yards.	Average Height in Feet.	Rate per cubic Yard.	Amount.	Length in Yards.	Cubical Content in Yards.	Average Depth in Feet.	Rate per cubic Yard.	Amount.
<i>M. fur.</i>				<i>ft. in.</i>	<i>Rs. a. p.</i>	<i>Rs. a.</i>			<i>ft. in.</i>	<i>Rs. a. p.</i>	<i>Rs. a.</i>
1 0	Soft clay - - -	1,760	11,661	2 6	- 1 -	729 13	-	-	-	-	-
2 0	Ditto - - -	-	-	-	-	-	13	50	1 6	- 10	2 10
0 0	Ditto - - -	1,747	13,483	2 9	- 1 -	842 11	-	-	-	-	-
3 0	Ditto - - -	-	-	-	-	-	80	225	1 3	- 10	11 12
0 0	Ditto - - -	1,662½	16,799	3 6	- 1 -	1,049 15	-	-	-	-	-
4 0	Loose, sandy and alluvial	1,751	22,170	4 3	- 1 -	1,385 10	-	-	-	-	-
5 0	Ditto - - -	-	-	-	-	-	22½	23	0 6	- 10	1 3
0 0	Ditto - - -	1,737½	8,639	2 0	- 11	406 1	-	-	-	-	-
6 0	Loose sandy - - -	-	-	-	-	-	68	364	1 6	- 10	13 12
0 0	Ditto - - -	1,692	21,141	4 3	- 1 -	1,321 5	-	-	-	-	-
7 0	Ditto - - -	1,760	18,038	3 9	- 1 -	1,127 6	-	-	-	-	-
8 0	Loose sand and laterite gravel.	1,760	32,429	4 5	- 1 2	2,364 10	-	-	-	-	-
9 0	Laterite gravel - - -	-	-	-	-	-	1,027½	37,982	9 3	- 2 -	4,747 12
0 0	Loose sandy - - -	692½	24,082	8 9	- 1 6	2,257 11	-	-	-	-	-
10 0	Ditto - - -	-	-	-	-	-	415½	4,711	4 0	- 1	294 7
0 0	Clayey - - -	1,344½	43,920	8 9	- 1 6	4,295 10	-	-	-	-	-
11 0	Red earth and gravelly	-	-	-	-	-	646	2,312	1 6	- 10	120 -
0 0	Loose sandy - - -	1,094	6,904	2 4	- 1 -	426 4	-	-	-	-	-
12 0	Laterite gravel, and light soft soil.	-	-	-	-	-	1,150	23,054	6 0	- 1 2	1,681 -
0 0	Ditto - - -	610	4,490	2 9	- 1 -	380 -	-	-	-	-	-
13 0	Light soft soil - - -	-	-	-	-	-	270	10,895	9 9	- 1 6	1,021 7
0 0	Ditto - - -	1,490	42,231	7 9	- 1 4	3,519 4	-	-	-	-	-
14 0	Ditto - - -	-	-	-	-	-	780	17,592	6 4	- 1 2	1,282 12
0 0	Ditto - - -	980	11,927	4 3	- 1 -	745 7	-	-	-	-	-
15 0	Ditto - - -	-	-	-	-	-	700	15,915	6 4	- 1 2	1,160 7
0 0	Ditto - - -	1,060	28,126	7 6	- 1 4	2,343 13	-	-	-	-	-
16 0	Ditto - - -	-	-	-	-	-	136½	133	0 3	- 10	6 15
0 0	Ditto - - -	1,620½	8,779	2 3	- 1 -	548 11	-	-	-	-	-
17 0	Ditto - - -	-	-	-	-	-	880	10,787	0 6	- 10	561 13
0 0	Ditto - - -	660	4,069	2 4	- 1 -	254 5	-	-	-	-	-
18 0	Ditto - - -	-	-	-	-	-	432	4,351	3 9	- 1 -	271 14
0 0	Ditto - - -	1,290	29,044	6 6	- 1 2	2,120 11	-	-	-	-	-
19 0	Ditto - - -	-	-	-	-	-	1,570	23,664	5 0	- 1 1	1,602 12
0 0	Ditto - - -	170	1,495	3 3	- 1 -	93 7	-	-	-	-	-
20 0	Ditto - - -	-	-	-	-	-	110	112	0 6	- 10	5 13
0 0	Ditto - - -	1,650	21,106	4 3	- 1 -	1,319 4	-	-	-	-	-
21 0	Ditto - - -	1,760	9,084	2 0	- 11	520 7	-	-	-	-	-
22 0	Clayey and soft light soil	-	-	-	-	-	8½	41	2 0	- 11	2 6
0 0	Ditto - - -	1,751½	35,362	8 0	- 1 4	2,946 13	-	-	-	-	-
23 0	Ditto - - -	-	-	-	-	-	163	1,167	2 9	- 1 -	72 11
0 0	Ditto - - -	1,597	24,550	5 0	- 1 1	1,662 4	-	-	-	-	-
24 0	Soft loose soil - - -	-	-	-	-	-	1,090	42,443	9 6	- 1 6	3,979 -
0 0	Ditto - - -	536½	1,346	1 0	- 10	64 14	-	-	-	-	-
25 0	Ditto - - -	1,760	14,691	3 0	- 1 -	918 3	-	-	-	-	-
26 0	Ditto - - -	1,760	6,964	1 4	- 10	341 14	-	-	-	-	-
27 0	Ditto - - -	-	-	-	-	-	52	184	1 6	- 10	9 9
0 0	Ditto - - -	1,705	16,103	3 6	- 1 -	1,006 7	-	-	-	-	-
28 0	Ditto - - -	-	-	-	-	-	123½	419	1 6	- 10	21 13
0 0	Ditto - - -	1,636½	12,540	2 9	- 1 -	763 12	-	-	-	-	-

Appendix (B.)

on the proposed Line of Railway between *Madras* and *Menil*.

STONE FACING.				Side Drains, Laterite Rough Stone, in Brick and Chusam.		Drains, Bridges, &c., vide Statement.		Foot Bridges.		Level Crossings.		TOTAL.
Length in Yards.	Cubical Content in Yards.	Rate per cubic Yard.	Amount.	Length in Yards.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	
		<i>Rs. a.</i>	<i>Rs. a.</i>		<i>Rs. a.</i>		<i>Rs. a.</i>		<i>Rs. a.</i>		<i>Rs. a.</i>	<i>Rs. a.</i>
-	-	-	-	-	-	-	-	-	1,000 -	3	450 -	2,178 13
180	270	1 -	270 -	-	-	1	100 -	-	2,000 -	1	150 -	3,365 5
105	157½	1 -	157 8	-	-	2	250 -	1	1,000 -	1	150 -	2,619 3
352	440	- 12	330 -	-	-	2	350 -	-	-	-	-	2,065 10
-	-	-	-	-	-	6	630 -	1	1,000 -	1	150 -	2,277 4
-	-	-	-	-	-	1	100 -	-	-	-	-	1,435 1
480	360	- 12	270 -	-	-	3	200 -	1	1,000 -	1	150 -	2,747 6
-	-	-	-	-	-	7	850 -	-	-	1	150 -	3,364 10
600	1,200	- 12	900 -	2,064½	2,064 11	1	750 -	-	-	-	-	10,710 2
400	2	- 12	150 -	-	-	2	850 -	1	1,000 -	-	-	6,590 1
-	-	-	-	-	-	1	350 -	-	-	1	150 -	1,045 11
-	-	-	-	2,300	2,300 -	1	300 -	1	1,000 -	1	150 -	5,711 -
-	-	-	-	540	540 -	2	545 -	1	1,000 -	1	150 -	6,775 11
-	-	-	-	1,560	1,560 -	2	515 -	1	1,000 -	-	-	5,103 3
600	900	- 12	675 -	1,400	1,400 -	2	595 -	-	-	1	150 -	6,324 4
-	-	-	-	-	-	2	200 -	1	1,000 -	-	-	1,755 10
-	-	-	-	-	-	1	225 -	-	-	-	-	1,041 2
-	-	-	-	-	-	2	325 -	1	1,000 -	-	-	3,717 9
100	150	- 12	112 8	-	-	-	-	1	1,000 -	1	150 -	2,905 3
460	690	- 12	517 8	-	-	5	1,200 -	-	-	-	-	3,042 9
-	-	-	-	-	-	3	300 -	1	1,000 -	-	-	1,820 7
800	1,200	- 12	900 -	-	-	5	625 -	1	1,000 -	1	150 -	5,624 3
-	-	-	-	-	-	2	510 -	1	1,000 -	1	150 -	3,394 15
-	-	-	-	2,180	2,180 -	-	-	-	-	-	-	6,223 14
-	-	-	-	-	-	5	500 -	1	1,000 -	1	150 -	2,568 3
-	-	-	-	-	-	5	690 -	1	1,000 -	1	150 -	2,151 14
338	567	- 12	380 4	-	-	-	-	-	-	1	150 -	1,546 4
1,133	1,343	- 12	1,007 4	-	-	3	535 -	-	-	1	150 -	2,497 13

Appendix (B.)—continued.

ESTIMATE of the probable cost of Earthwork, Drains, Bridges, &c.

Number of Miles.	Description of Soil.	EMBANKMENT.					CUTTING.				
		Length in Yards.	Cubical Content in Yards.	Average Height in Feet.	Rate per cubic Yard.	Amount.	Length in Yards.	Cubical Content in Yards.	Average Depth in Feet.	Rate per cubic Yard.	Amount.
<i>M. fur.</i>				<i>ft. in.</i>	<i>Rt. a. p.</i>	<i>Rs. a.</i>			<i>ft. in.</i>	<i>Rt. a. p.</i>	<i>Rs. a.</i>
29 0	Soft loose soil - -	1,760	18,944	3 9	- 1 -	1,184 -	- -	- -	- -	- -	- -
30 0	Ditto - - -	-	-	-	-	-	18½	12	0 3	- 10	- 10
0 0	Ditto - - -	1,741½	19,359	3 0	- 1 -	1,222 7	-	-	-	-	-
31 0	Ditto - - -	1,494½	14,062	3 6	- 1 -	878 14	-	-	-	-	-
32 0	Ditto - - -	-	-	-	-	-	99	273	1 3	- 10	14 4
0 0	Ditto - - -	1,661	13,538	3 0	- 1 -	846 3	-	-	-	-	-
33 0	Ditto - - -	1,760	16,486	3 6	-	1,030 6	-	-	-	-	-
34 0	Clayey - - -	1,760	26,033	4 9	- 1 1	1,762 10	-	-	-	-	-
35 0	Soft loose soil - -	-	-	-	-	-	440	961	1 0	- 10	50 1
0 0	Ditto - - -	1,320	5,716	1 3	- 10	297 11	-	-	-	-	-
36 0	Gravelly, stony and soft clay.	1,740	23,673	4 6	- 1 1	1,602 14	-	-	-	-	-
37 0	Ditto - - -	-	-	-	-	-	480	3,745	3 0	- 1 1	253 9
0 0	Ditto - - -	1,280	23,456	5 9	- 1 2	1,710 5	-	-	-	-	-
38 0	Gravelly, stony and clayey.	-	-	-	-	-	160	553	1 6	- 11	31 12
0 0	Ditto - - -	1,600	47,193	8 0	- 1 6	4,424 6	-	-	-	-	-
39 0	Clayey and gravelly hard soil.	-	-	-	-	-	510	2,511	2 0	- 1 1	170 -
0 0	Ditto - - -	1,250	8,979	2 6	- 1 1	607 15	-	-	-	-	-
40 0	Gravelly and hard soil	-	-	-	-	-	1,760	13,900	3 0	- 1 2	1,013 8
41 0	Gravelly and clayey	-	-	-	-	-	1,100	29,161	7 6	- 1 4	2,430 1
0 0	Ditto - - -	660	15,275	6 6	- 1 6	1,272 15	-	-	-	-	-
42 0	Clayey, gravelly hard soil.	-	-	-	-	-	720	4,161	2 3	- 1 1	281 12
0 0	Ditto - - -	820	7,796	3 6	- 1 2	568 7	-	-	-	-	-
43 0	Gravelly hard soil - -	-	-	-	-	-	900	6,240	2 9	- 1 2	455 -
0 0	Ditto - - -	860	3,231	1 6	- 1 1	218 3	-	-	-	-	-
44 0	Ditto - - -	-	-	-	-	-	1,405	22,287	5 0	- 1 3	1,741 3
0 0	Ditto - - -	335	2,672	2 6	- 1 1	140 5	-	-	-	-	-
45 0	Ditto - - -	-	-	-	-	-	1,050	36,376	8 9	- 1 6	3,410 14
0 0	Ditto - - -	710	11,053	5 0	- 1 3	863 8	-	-	-	-	-
46 0	Ditto - - -	-	-	-	-	-	1,090	13,891	4 3	- 1 2	1,012 14
0 0	Ditto - - -	670	4,776	2 6	- 1 1	-	-	-	-	-	-
47 0	Ditto - - -	-	-	-	-	-	1,055	24,983	6 9	- 1 4	2,081 15
0 0	Ditto - - -	703	11,799	5 3	- 1 3	921 13	-	-	-	-	-
48 0	Ditto - - -	-	-	-	-	-	610	6,584	4 0	- 1 2	501 15
0 0	Ditto - - -	1,150	13,362	4 0	- 1 2	974 5	-	-	-	-	-
49 4½	Ditto - - -	1,073½	13,967	4 6	- 1 2	1,018 7	-	-	-	-	-
	TOTAL - - -	-	793,495	-	-	57,633 7	-	362,964	-	-	30,321 1

Appendix (B.)—continued.

on the proposed Line of Railway between Madras and Mēnil—continued.

STONE FACING.				Side Drains, Laterite Rough Stone, in Brick and Chuanam.		Drains, Bridges, &c., vide Statement.		Foot Bridges.		Level Crossings.		TOTAL.
Length in Yards.	Cubical Content in Yards.	Rate per cubic Yard.	Amount.	Length in Yards.	Amount.	No.	Amount.	No.	Amount.	No.	Amount.	
1,100	880	Rs. a. — 12	Rs. a. 660 -	-	-	2	Rs. a. 1,110 -	1	Rs. a. 1,000 -	1	Rs. a. 150 -	Rs. a. 4,104 -
496	319½	— 12	239 10	-	-	1	420 -	1	1,000 -	-	-	2,682 11
-	-	-	-	-	-	4	50,465 -	-	-	-	-	51,343 14
-	-	-	-	-	-	10	1,310 -	2	2,000 -	1	150 -	4,320 6
-	-	-	-	-	-	8	800 -	-	-	-	-	1,830 6
-	-	-	-	-	-	2	1,700 -	-	-	1	150 -	3,612 10
-	-	-	-	-	-	6	770 -	1	1,000 -	-	-	2,117 12
-	-	-	-	-	-	1	675 -	-	-	-	-	2,277 14
-	-	-	-	-	-	1	1,030 -	-	-	-	150 -	3,163 14
-	-	-	-	-	-	3	550 -	1	1,000 -	-	-	6,006 2
-	-	-	-	-	-	2	350 -	1	1,000 -	1	150 -	3,277 14
-	-	-	-	-	-	-	-	-	-	1	150 -	1,163 8
650	812½	— 12	609 6	2,200	2,200 -	1	290 -	-	-	1	150 -	6,952 6
-	-	-	-	-	-	1	225 -	1	1,000 -	1	150 -	2,225 3
-	-	-	-	-	-	1	375 -	1	1,000 -	1	150 -	2,198 3
-	-	-	-	-	-	1	375 -	1	1,000 -	1	150 -	3,406 8
-	-	-	-	2,100	2,100 -	3	805 -	1	1,000 -	1	150 -	8,329 6
-	-	-	-	-	-	1	160 -	1	1,000 -	-	-	2,516 4
-	-	-	-	2,110	2,110 -	2	420 -	-	-	1	150 -	5,683 12
-	-	-	-	-	-	1	100 -	1	1,000 -	1	150 -	2,726 ¼
-	-	-	-	-	-	2	750 -	-	-	-	-	1,768 7
-	-	-	7,179 -	-	16,444 11	-	74,215 -	-	31,000 -	-	4,800 -	2,21,593 3

Appendix (C.)

ESTIMATE OF BRIDGES AND DRAINS required on the proposed Line of Railway between
Madras and Menil.

Number.	Miles.	NATURE OF WORK.	Number of Vents.	Span.	Height of Piers.	Probable Cost of each.	Estimated Cost for each Mile.
						£. s. d.	£. s. d.
1	2	Irrigation channel	1	3	1	100 - -	100 - -
2	3	- ditto	1	3	1	100 - -	
3	-	Culvert	1	5	2	150 - -	250 - -
4	4	- ditto	1	5	2	150 - -	
5	-	- ditto	1	5	2	200 - -	350 - -
6	5	- ditto	2	4	1½	130 - -	
7	-	Irrigation channel	1	3	1	100 - -	
8	-	- ditto	1	3	1	100 - -	680 - -
9	-	- ditto	1	3	1	100 - -	
10	-	- ditto	1	3	1	100 - -	
11	-	- ditto	1	3	1	100 - -	
12	6	- ditto	1	3	1	100 - -	100 - -
13	7	- ditto	1	3	1	100 - -	
14	-	- ditto	1	3	1	100 - -	200 - -
15	8	- ditto	1	3	1	100 - -	
16	-	- ditto	1	3	1	100 - -	
17	-	- ditto	1	3	1	100 - -	
18	-	- ditto	1	3	1	100 - -	850 - -
19	-	- ditto	1	3	1	100 - -	
20	-	- ditto	1	3	1	100 - -	
21	-	Bridge	1	8	3	250 - -	
22	9	- ditto	1	18	4	750 - -	750 - -
23	10	- ditto	1	18	4	750 - -	850 - -
24	-	Irrigation channel	1	3	1	100 - -	
25	11	Bridge	4	5	1½	350 - -	350 - -
26	12	- ditto	3	6	1½	300 - -	300 - -
27	13	- ditto	1	6	2	225 - -	545 - -
28	-	- ditto	1	12	2	320 - -	
29	14	- ditto	1	6	2	225 - -	515 - -
30	-	- ditto	1	10	3	290 - -	
31	15	- ditto	1	10	2	275 - -	695 - -
32	-	Culvert	1	10	4	320 - -	
33	16	Irrigation channel	1	3	1	100 - -	200 - -
34	-	- ditto	1	3	1	100 - -	
35	17	Bridge	1	6	2	225 - -	325 - -
36	18	- ditto	1	6	2	225 - -	325 - -
37	-	Irrigation channel	1	3	1	100 - -	
38	20	Bridge	2	15	3	800 - -	
39	-	Irrigation channel	1	3	1	100 - -	1,200 - -
40	-	- ditto	1	3	1	100 - -	
41	-	- ditto	1	3	1	100 - -	
42	-	- ditto	1	3	1	100 - -	
43	21	- ditto	1	3	1	100 - -	300 - -
44	-	- ditto	1	3	1	100 - -	
45	-	- ditto	1	3	1	100 - -	
46	22	- ditto	1	3	1	100 - -	
47	-	- ditto	1	3	1	100 - -	625 - -
48	-	- ditto	1	3	1	100 - -	
49	-	- ditto	1	3	1	100 - -	
50	-	Culvert	1	6	2	225 - -	
51	23	Bridge	1	6	3	225 - -	510 - -
52	-	- ditto	1	6	3	225 - -	
53	25	Irrigation channel	1	3	1	100 - -	
54	-	- ditto	1	3	1	100 - -	
55	-	- ditto	1	3	1	100 - -	500 - -
56	-	- ditto	1	3	1	100 - -	
57	-	- ditto	1	3	1	100 - -	
58	26	Bridge	1	8	4	280 - -	
59	-	Irrigation channel	1	3	1	100 - -	690 - -
60	-	- ditto	1	3	1	100 - -	
61	-	- ditto	1	3	1	100 - -	
62	-	- ditto	1	3	1	100 - -	

Number.	Miles.	NATURE OF WORK.	Number of Vents.	Span.	Height of Piers.	Probable Cost of each.	Estimated Cost for each Mile.
						£. s. d.	£. s. d.
63	28	Culvert - - -	1	6	2	225 - -	535 - -
64	-	Irrigation channel - -	1	3	1	100 - -	
65	-	Culvert - - -	1	8	-	210 - -	
66	29	- ditto - - -	1	8	-	210 - -	1,110 - -
67	-	Bridge - - -	3	15	3	900 - -	
68	30	- ditto - - -	2	8	-	420 - -	
69	31	- ditto - - -	1	3½	2½	140 - -	50,465 - -
70	-	Irrigation channel - -	1	3	1	100 - -	
71	-	Culvert - - -	1	6	2	225 - -	
72	-	- Large bridge across Coortilliar.	30	30	6	50,000 - -	
73	32	Bridge - - -	1	6	4	275 - -	1,310 - -
74	-	- ditto - - -	1	3	2	125 - -	
75	-	Irrigation channel - -	1	3	1	100 - -	
76	-	- ditto - - -	1	3	1	100 - -	
77	-	- ditto - - -	1	3	1	100 - -	
78	-	- ditto - - -	1	3	1	100 - -	
79	-	- ditto - - -	1	3	1	100 - -	
80	-	- ditto - - -	1	3	1	100 - -	
81	-	- ditto - - -	1	3	1	100 - -	800 - -
82	-	Bridge - - -	1	5	3	210 - -	
83	33	Irrigation channel - -	1	3	1	100 - -	
84	-	- ditto - - -	1	3	1	100 - -	
85	-	- ditto - - -	1	3	1	100 - -	
86	-	- ditto - - -	1	3	1	100 - -	
87	-	- ditto - - -	1	3	1	100 - -	
88	-	- ditto - - -	1	3	1	100 - -	
89	-	- ditto - - -	1	3	1	100 - -	1,700 - -
90	-	- ditto - - -	1	3	1	100 - -	
91	34	Bridge - - -	2	10	3½	650 - -	
92	-	- ditto - - -	3	15	5	1,050 - -	
93	35	- ditto - - -	1	8	2	270 - -	
94	-	Irrigation channel - -	1	3	1	100 - -	
95	-	- ditto - - -	1	3	1	100 - -	
96	-	- ditto - - -	1	3	1	100 - -	
97	-	- ditto - - -	1	3	1	100 - -	770 - -
98	-	- ditto - - -	1	3	1	100 - -	
99	36	Bridge - - -	2	10	4	675 - -	
100	37	- ditto - - -	3	15	5	1,050 - -	
101	38	- ditto - - -	1	12	3	350 - -	
102	-	Irrigation channel - -	1	3	1	100 - -	
103	-	- ditto - - -	1	3	1	100 - -	
104	39	Bridge - - -	1	6	3	250 - -	
105	-	Irrigation channel - -	1	3	1	100 - -	350 - -
106	41	Bridge - - -	1	10	3	290 - -	
107	42	- ditto - - -	1	6	2	225 - -	
108	43	- ditto - - -	3	4	-	375 - -	375 - -
109	44	- ditto - - -	3	4	-	375 - -	
110	45	- ditto - - -	5	4	-	475 - -	
111	-	Irrigation channel - -	1	3	1	100 - -	805 - -
112	-	Bridge - - -	1	8	2½	230 - -	
113	46	- ditto - - -	1	6	-	180 - -	
114	47	- ditto - - -	1	12	2	320 - -	420 - -
115	-	Irrigation channel - -	1	3	1	100 - -	
116	48	- ditto - - -	1	3	1	100 - -	
117	49	Bridge - - -	3	9	1½	650 - -	750 - -
118	-	Irrigation channel - -	1	3	1	100 - -	
						£.	74,215 - -

(signed) T. T. Peary.

Appendix (D.)

ESTIMATE of the Probable Cost of laying the Permanent Way for a Single Line Railway from Madras to Menil, 50 Miles, including Sidings.

	Per Mile.		
	Rs.	a.	p.
Rails, 60 lbs. to the yard :			
Wrought iron rails, 94.3 tons, at 9 l. - - - - -	8,484	-	-
5,283 cubic feet, at 1 rupee	5,283	-	-
Chairs, 706, joint - - - } 25 tons, at 7 l. - - - - -	1,750	-	-
Ditto, 2,816 intermediate	2,200	-	-
Ballast, 2,200 cubic yards, at 1 rupee	221	-	-
3,522 keys, at 1 anna each	487	-	-
7,750 spikes or trenails, at 1 anna	400	-	-
Laying rails - - - - -	172	-	-
Sundries - - - - -			
TOTAL for one Mile - - - - -	19,000	-	-
Ditto for 50 Miles - - - - -	Rs. 9,50,000	-	-

(signed) T. T. Pears.

EXTRACT from the Minutes of Consultation, No. 35, Public Department, dated 12th January 1852.

Para. 1. IN Minutes of Consultation, No. 812, dated 29th August 1851, the Government, considering the line running nearly due west from Madras by Menil to be one decidedly preferable for a trunk railway, to serve as a basis whence similar ways could be carried in the direction of the Mysore country and the ceded districts on the one hand, and towards Vellore, Salem, &c. on the other, Major Pears was instructed to survey that line as far as Menil, or onwards to some place on the right bank of the Poiney River, convenient for the divergence of the line towards Vellore and the Ghauts respectively.

2. Major Pears having completed the survey of this line as far as Menil, now submits a report upon it, with an estimate of the cost of a railway to that place, distant from Madras 48 miles. The survey has proved the line to be most eligible. It offers no difficulties of any kind, and the country through which it passes is much more favourable than that on the line to Wallajahnuggur before surveyed. The earthwork, though the amount per mile is nearly the same as in the Wallajahnuggur line, will cost less, from the soil being more easily wrought. The works of masonry required are of the commonest and most trifling description, with exception of a bridge over the Coortilliar, the construction of which will be a work of the simplest kind. The cost of this bridge for a single line of rails Major Pears estimates at 50,000 rupees.

3. The steepest gradient is only 1 on 309, the whole rise from Madras to Menil being 360 feet: the gradients in the line by Menil being more favourable than on that to Wallajahnuggur, the working expenses would of course be lighter. The total cost per mile is 36,488 rupees, including permanent way, rolling stock, &c., estimated on the same data as were adopted in the estimate for the Wallajahnuggur line.

4. It is not to be understood that Menil is a desirable terminus: it is only to be looked upon as a point to which, whatever may be the ulterior purpose, a railway to the westward may be carried with certainty that it is on the right line; and the Government concur with Major Pears that the line to Menil, the best for a trunk line, should be substituted for that previously surveyed to Wallajahnuggur.

5. The circumstances to which Major Pears refers as conspiring to prompt and encourage an undertaking of this nature in this part of the country and at this juncture are very important. The surveys and estimate show that this

Presidency

Presidency offers facilities and advantages for railroad construction greatly beyond those possessed by the other Presidencies; whilst its need of a superior land communication from its central district to the coast is as obvious; and, upon mature consideration of the subject in all its bearings, the Government deem it decidedly their duty to make an earnest application to the Honourable the Court of Directors for their sanction to the construction of a railway on this line as a public work at the expense of the State, and for authority to commence it immediately, if sanction is accorded, beginning with the portion indicated by Major Pears in the 37th para. of his report, and proceeding as he recommends, adopting his estimate for the earthwork and masonry, during the progress of which the other parts of the estimate can be tested in such manner as the Honourable Court may deem fit.

6. Major Pears' remarks on his examination of the Ghats leading into the upper country, so far as it has gone, are highly satisfactory, as are likewise his observations with regard to the general features of the country between Madras and Menil, the facility with which labour can be rendered available, the period within which a portion at least of the railway might be completed, and the almost certain impulse which it would give to traffic, not merely on the immediate line, but to and from the districts lying within its influence.

pp 34-37.

7. Major Pears will, therefore, proceed with his survey of the Ghats and of the intermediate country, with a view to determine the most favourable line of ascent from the plain to the Balaghat, and of approach to the place at which the ascent will best commence, studying to carry the trunk road as far forward as it can conveniently serve in common for a line in that direction, as well as for one by Vellore to Vanienbady.

8. The Governor in Council is glad to observe, that from the partial examination he has already made of the Ghats, Major Pears is sanguine that the difficulty of ascending them will be overcome at much less cost than has generally been anticipated.

9. Referring to Major Pears's estimate for the bridge over the Coortilliar as for a single line, the Government consider it expedient that the bridges, at least on the trunk lines, should be adapted for a double railway.

10. Should the Honourable Court accord their sanction to the work, the necessary orders will be given for the employment of a detachment of sappers and miners on the railway, and Major Pears's suggestion regarding convicts and buildings for their accommodation, will receive consideration.

(True extract.)

(signed) *H. C. Montgomery,*
Chief Secretary.

From Major *T. T. Pears*, C. B., Engineers, to the Chief Secretary to Government, Fort St. George.

Sir,

Palmanair, 6 July 1852.

1. By an extract from Minutes of Consultation in the Public Department (No. 35), dated the 12th January 1852 (para. 7), I was instructed to proceed with a survey of the Ghats, and of the intermediate country, with a view to determine the most favourable line of ascent from the plain to the Balaghat, and of approach to the place at which ascent will best commence. Studying to carry the trunk road as far forward as it can conveniently serve in common for a line in that direction, as well as for one by Vellore to Vanienbady, I have now the honour to submit a report of the result of my inquiries up to the present time.

2. Assuming that a line running nearly due west from Madras, for 60 miles at least, is acknowledged to be the best for us to begin with as the trunk from which ramifications might be made to Salem, Bangalore and Bellary, the desiderata for a passage up the Ghats are—

1st. That the pass should be made with the best possible gradients and curves, at the least possible cost.

787.

H

2dly. That

2dly. That it should be in the most favourable position with reference to the proposed line from the termination of the above trunk to Bellary.

3dly. That the same pass should serve for the Bangalore as well as the Bellary line.

3. With respect to the first of these, it is to be observed, that the Eastern Ghauts, as they are commonly termed (which a line from Madras must pass to communicate with the Bombay or the north-western portion of our own Presidency), constitute here the steep and rugged slope of the Mysore tableland. Their elevation above the sea at their crest (as at Palmanair or Naikenary) is about 2,000 or 2,100 feet. The portion of the Ghauts with which we have to do, stands at a distance of about 110 or 120 miles from Madras.

4. We have, therefore, to begin a line to Bellary and Bangalore, by surmounting an elevation of 2,000 feet within the first 120 miles, and are led to the consideration of two different modes of accomplishing this; the one, by running to the base of the Ghauts on a nearly level plain, reserving the greater part of the height to be overcome at the Ghaut itself; the other, by selecting a line which shall lift us gradually towards the crest of the Ghauts, and leave as small a portion as possible of the height to be overcome by an abrupt pass.

5. In looking carefully over the map, two such lines present themselves to us here, leading nearly westward from Madras to the Ghauts. The one, falling on the bank of the Palaur, near Trevallum, would follow that river to Polecondah; and thence along the bank of the Goriattum river to Goriattum, and from thence at an increased rate of ascent, to the foot of the Ghauts beyond Lallpet, at which point it would have reached an elevation of about 1,100 feet, and a distance (from Madras) of 115 miles, having risen at an average rate of nine and a half feet in a mile; 900 or 1,000 feet would thus be left for the Ghaut.

6. On the other hand, if we carry a line from Madras, by Poiney, to the vicinity of Mooglee, we find that on reaching there the foot of the Ghauts (a distance of about 115 miles), we have ascended 1,600 feet, and that there remain but 500, or somewhat less, on the Ghaut itself.

7. Of two such projects, all other things being alike, the cost of the work, the gradients, and other characteristics of the passes, the same preference would be given to that which concentrated the rise at the Ghaut itself, running by very easy gradients up to its base. It would be preferable as a whole, still more decidedly so, when considered with reference to that considerable amount of traffic which has only to do with the portion below the Ghauts.

8. As far as the lateral traffic is concerned which falls upon the line short of the Ghauts, it is evident, the greater part of it having a downward tendency towards the sea, that the line kept on the lower level would be, to a certain extent, more advantageous than one raised to a level above the sources of that traffic. Considerations such as these are entitled to some weight, though perhaps not much in this case.

9. The great difficulty, however, when so great a height is reserved for the Ghaut itself, is to find a favourable pass. Thus, in the two cases above mentioned, we should in the one have to overcome at the pass itself 1,000 feet, in the other, 500; the length of the pass (the slopes being the same), would be in the former double that of the latter; while the difficulty and improbability of getting favourable curves would be proportionately enhanced.

10. I have examined the Ghauts between Toombah Droog (north of Palmanair) and Naikenary, and my attention has been particularly directed to the neighbourhood of the two latter places; the former appears to promise the best pass; the latter, the best approach to the pass.

11. The Ghauts about Naikenary, and between that and Cuddapahnuttum, are exceedingly rugged; the ravines generally narrow and abrupt. There is one very remarkable ravine, which appears on the map to run in nearly a direct line from the plain above, near Moolwagle, to the foot of the Ghauts, near the bottom of the old Naikenary Pass.

12. This I examined with care; and I came to the conclusion that, although it seemed to offer a singularly direct and convenient line for a railway, to be carried

carried by a gradual slope up to the higher country, such a work could not be executed without a vast expenditure of money, nor be subsequently maintained but at a constant and great cost. The sides of the ravine (which is remarkably narrow) are very steep; and though apparently direct, it is tortuous enough to render the construction of a straight line of railway very expensive; while the steepness of its rocky sides would render necessary a large amount of building and very expensive cutting in laying a line of railway along either of them. Seeing these difficulties, and the more favourable position of Palmanair, I turned my attention to that neighbourhood.

13. It would be readily observed, in looking at the map, that that part of the district of North Arcot which lies below the Ghauts and between the Rivers Palaur and Poiney, is divided into two portions by a ridge, which sinks gradually as it extends, in an indirect line, from a point a little south of Mooglee to Trivallum, near the junction of the two rivers.

14. This water-shed, the sides of which are intersected by numerous bold rocky ranges of hills, throws off the water in numberless streams to the Palaur on the one hand, to the Poiney on the other. The ridge abuts against the Ghauts at the village Taikmana, at an elevation which only leaves about 440 feet to be surmounted in ascending to the plains above.

15. I had ascertained, as stated in my report of 5th March 1851, that a line might be carried without difficulty to the foot of the Ghauts in this vicinity; it only remained, therefore, to find a convenient pass near Taikmana.

Para. 89.

16. The line which I have selected for the pass, after a very careful examination of the neighbouring country, starts near Taikmana, and, running up a valley south of, and immediately under, Mooglee Hill, reaches the top of the Ghauts, not far from the village of Mussulmarroo, about four miles south of Palmanair; it would then be continued over an undulating but very favourable country by the village of Pengragoonta, and, sweeping gradually to the north, would cross the present high road to Bangalore (from Madras and Chittoor), at a point two miles west of Palmanair; and here I propose that my present survey shall end.

17. The pass is four miles in length; the total ascent is 440 feet, being an average of 110 feet in a mile; the maximum slope is 1 in 36 or 37, according to two sets of trial sections which have been taken. Its length is divided into four parts, beginning at the bottom; viz.—

1st. A direct line for about	-	-	-	1,100 yards.
2d. A curve (to a radius of one mile)	-	-	-	1,000 "
3d. A direct line	-	-	-	3,600 "
4th. A curve to a radius of one mile	-	-	-	1,300 "

18. I do not anticipate that the construction of a railway on this pass will be attended with any difficulty, or with any very great expense. I have been struck with the singularly fortunate concurrence of the point of least elevation with one of the most direct and open valleys I have seen along the whole range.

19. With regard to the applicability of locomotive power on a slope of 1 in 36 or 37 (in an economical point of view), although I have notes of many steeper gradients so worked, it will be sufficient to instance the case of the well-known "Lickey incline" on the Birmingham and Gloucester Railway.

20. The length of this incline is two miles and three chains, with a uniform gradient of 1 in 37; this has been always worked by locomotive power, at one time by the aid of an assistant engine. Mr. McConnell, Superintendent of the Locomotive Department on that railway, stated before the Parliamentary (Gauge) Committee in 1845, that they had constructed an engine (which he describes) to work the incline without assistance; and that the engine carried a load of from 135 to 148 tons up the incline, at a rate of from 8 to 10 miles an hour: other examples show that trains may be worked down such inclines with perfect safety.

21. The other two desiderata for a pass up the Ghauts may be discussed in a few words. The object in this case being to get to Bellary, it will be found

that, though Palmanair appears somewhat south and west of a direct line, any attempt to pass to the northward would not only lead to a difficult part of the country below the Ghauts, but would entangle us among the hilly districts of Cuddapah above. Not only, therefore, have we a favourable line to this Ghaut, and a very convenient pass up, but we have the most direct line to Bellary that is to be found on anything like a favourable country.

22. I assume that we shall be obliged to pass to the westward of the Cuddapah district, to run (supposing it was determined to make a direct line to Bellary) towards Bangapilly from Palmanair, and to pass, when opportunity offered, into the Valley of the Pennar.

23. Further, with respect to this pass serving also for Bangalore, I need only add that it is in the direct line to that place from Madras; and the construction of a line from the head of the pass to that station would be attended with no difficulty.

24. Under these circumstances, I have not hesitated in undertaking a survey and estimate from Menil towards and up this pass, feeling assured that no other will be found so favourable, upon the whole, for a great trunk line of railway; and I shall describe the course of the line in a few words, leaving more particular report upon it to be submitted hereafter with the survey.

25. The line, starting from Menil, passes near the village of Quodekel, and follows a nearly westerly course till it arrives at the Poiney river, when it turns up the left bank of that river, passes the village of Poiney, four miles above which it turns short round, and crosses the river; it then pursues again a nearly westerly course, by Vencatapoorum, Narsapilly (four miles south of Chittoor) and Yadanari, passing up a succession of valleys, separated from each other by slight saddles. Approaching Vencatagerry, it has the choice of striking through, or turning by the north, a bold range of hills, which in this case cross its path; it then sweeps round the Valley of Bungaroo Pollium (near Vencatagerry), and runs up, at an increasing rate of ascent, to Taikmana.

26. From Menil to the Poiney the line is generally very favourable; from thence to Taikmana the average rate of ascent is greater, being about 25 feet in the mile, and the country becomes rugged.

I shall endeavour to submit the survey and estimates with as little delay as possible.

27. In the meantime, having satisfied myself that this is the most eligible line for a passage up the Ghauts, I have considered it my duty to make this preliminary report thereon, seeing that the question of the first line to be sanctioned depends in so great a measure on the best position for the pass, and that Government might desire to be informed on this point without delay.

28. Although a railway up the Amboor Valley to Vaniembady might, doubtless, be constructed at a much less cost than that now under consideration to Palmanair, the line which I have selected for the latter is much more favourable than I expected to find across a country justly described by the late Captain Best as "covered with rocks and rocky hills;" while the proposed pass up the Ghauts exhibits many unexpected and favourable features. Under these circumstances, the question of the choice between the two for an experimental line assumes a new aspect.

29. Of the superior value of this (the Bellary) line, in a political point of view, there can be no doubt; neither can there be any question, I think, as to its greater ultimate importance to the agricultural and commercial interests of this Presidency. How far the first, the experimental portion of it, would fall short of the other as a remunerative undertaking, must depend greatly upon the cost of construction: unless the estimated cost of this exceeds that of the other to a very serious extent, the Government will probably consider the superior importance of this, as a trunk line, gives it the preference over the other as the work to be first undertaken. I may observe here, that the pass up these Ghauts once overcome, the way to the north-west lies open; neither, as far as I know of the country, do I believe any serious difficulty to remain between that and Poonah.

30. I have

30. I have not yet looked at the Ghauts south of Naikenary; but it is my intention to proceed in a few days to Kangoondy, and while this survey is under preparation to examine the Ghauts in the neighbourhood of Vaniembady. From what I already know of that country, I have no expectation of finding any pass for a railway that shall offer in itself advantages over that near Taikmana sufficient to counterbalance the disadvantages of its position with reference to the proposed trunk line.

I have, &c.
(signed) T. T. Pears,
Railway Commissioner.

EXTRACT from the Minutes of Consultation, No. 724, Public Department,
dated 28 July 1852.

Para. 1. In the foregoing report Major Pears lays before Government the result of his survey of the Ghauts, and the intermediate country between them and Menil, up to which place his previous survey extended.

2. The portion of the Ghauts to be surmounted is distant about 110 or 120 miles from Madras, and rises about 2,000 or 2,100 feet above the sea. Para. 2.
To accomplish this, two modes have been considered—one by running a line to the base of the Ghauts on a nearly level plain, beyond Lallpet, whereby an elevation of about 1,100 feet, and a distance of 115 miles from Madras, will be attained, leaving 900 or 1,000 feet to be overcome at the Ghaut itself; the other by conveying a line by Poiney to the vicinity of Moogley, by which a distance of about 115 miles will be gained, and an ascent of 1,600 feet, leaving but 500, or somewhat less, to be surmounted. Whatever advantages the former line may possess over the latter in its easier approach to the Ghauts, and in affording greater facilities for traffic, the greater difficulty of finding a favourable pass when a height of 1,000 feet is to be overcome at the Ghaut itself, has led Major Pears to give the preference to the latter line, which he asserts can be carried without difficulty to the foot of the Ghauts, in the vicinity of Taikmana, whence the line he has selected for the pass commences, and, pursuing the course described in para. 16 of the Report, crosses the present high road to Bangalore, at a point 2 miles west of Palmanair, the pass, moreover, serving as well for the Bellary as for the Bangalore line. Para. 4 and 6.
Para. 7 and 9.
Para. 25.
Para. 15.
Para. 16.
Para. 21.

3. The favourable features of the portion of the country through which the railroad is proposed to be carried, coupled with the importance of this line in a political point of view as regards Bellary, offer, in the opinion of Major Pears, a sufficient reason for giving it preference also over a line up the Amboor Valley to Vaniembady, though the latter might be constructed at a much less cost. The Ghauts in this neighbourhood, Major Pears, it is observed, proposes now to examine.

4. In reviewing the arguments adduced by Major Pears in favour of the line he has selected for a railroad, the Governor in Council has to express his gratification at the favourable result of the careful survey conducted by the Commissioner, as detailed in his present highly satisfactory report on the Ghauts.

5. A copy of the report, with the views of Government thereon, will be forwarded to the Honourable Court by the next mail, with an intimation that the survey and estimates promised in the 26th para. will, when received, be also transmitted.

6. Copies of Major Pears's Report and of these proceedings, also copies of the Minutes of Consultation of the 12th August last, and the Commissioner's Report to which they refer, will be also forwarded to the Madras Railway Committee.

(True extract.)

(signed) H. C. Montgomery,
Chief Secretary.

Public Department, No. 1,048.

Home Cons.
22 December 1852,
No. 23 A.

EXTRACT from the Minutes of Consultation, under date 9 November 1852.

Read the following letter from Major Pears, Railway Commissioner.

(Here enter 27 October 1852.)

1. THE Right Honourable the Governor in Council has perused with great interest and satisfaction the very clear and excellent report submitted by Major Pears, the Railway Commissioner, on the result of his examination of the Ghauts in the neighbourhood of Vaniembady. It appears to him to afford the most ample information, not only as to the whole range of Ghauts over which a railway leading into the interior from Madras must be led, but also as to the best line.

2. The lines proposed by Major Pears to be first constructed, amount to nearly 260 miles in length, and consist of five parts; viz.—

1st. A trunk line to Menil	-	-	-	-	48 miles.
2d. A branch to Vellore and Vaniembady	-	-	-	-	70 "
3d. The trunk line continued to foot of the Ghaut	-	-	-	-	53 "
4th. The Ghaut near Palmanair	-	-	-	-	4 "
5th. From top of the Ghaut to Bangalore	-	-	-	-	84 "
					259 "

The cost of construction and stocking is estimated at an average of 40,000 rupees per mile, which would give the total capital required 1,04,00,000 rupees, or something more than one million sterling. The interest on this, at 4½ per cent., amounts to 4,68,000 rupees, which, computing the working expenses at 50 per cent. on the receipts, it is stated would require an annual mileage of 57,600 tons upon the whole extent of way, or traffic of various kinds equivalent to it. Major Pears observes, that the traffic between Madras and Wallajah-nuggur may be even now taken, on a very reasonable estimate, at 50,000 tons of goods, besides parcels and passengers, and that when the vast influence the proposed lines would exercise upon some of the finest districts in Southern India, the impulse they would give to education and commerce, and their importance also in a political point of view, are considered, he cannot doubt either of the success of the work as a speculation, or of the great and lasting benefits it is calculated to confer on all classes of people in this part of India.

3. The Governor in Council will briefly remark, that he still retains the opinion he formerly recorded, that the chief trunk railway should run direct west from Madras to Menil, where it will divide into two original branches, one leading up the Ghaut near Palmanair, and the other to Vaniembady; of these original branches, that by Palmanair, and thence to Bangalore and Bellary, is, in his opinion, by far the most important in all points of view, though it may not at the very outset prove so profitable. He would, however, also strongly urge the formation at an early date of the second line by Vellore to Vaniembady, connecting the Southern and Western Provinces with the Presidency.

4. As the selection of the line has been left by the Honourable Court to the Government of India, the Governor in Council resolves to transmit to them without delay, a copy of Major Pears's report, and to solicit their early orders on the subject.

5. Though not immediately connected with the railway question, the Government consider it desirable that the road described in the 13th para. of Major Pears's report as leading "over an easy country" from Coppun (six miles west of Kongoody) to the top of the Ghaut near the village of Sadainoor, "and presented from bottom to top one continued and easy slope, without in any single case the appearance of steepness or difficulty," should be opened up for carts the whole way to Bangalore, and with this view they will take an early opportunity of appointing a competent officer to be employed under the orders of Major Pears in examining the line and framing an estimate for the formation of a road.

(True extract.)

(signed) *H. C. Montgomery,*
Chief Secretary.

MINUTE

MINUTE by the Most Noble the Governor-General, dated the
14th December 1852.

MADRAS RAILWAY.

ACQUAINT Government of Madras, that as the Honourable Court has directed that the opinion of the Supreme Government should be taken regarding the line or lines of railway to be adopted in the Presidency of Madras, the Governor-general in Council has been desirous of communicating his views on the subject with the least practicable delay.

Home Cons.
22 December 1852,
No. 26.

But the Honourable Court has at the same time addressed to the Governor-general in Council a despatch upon Indian railways generally, which they refer for his careful consideration and judgment. The subject is of the highest importance and of large scope; and upon the decision of it must depend the judgment to be formed regarding railways in Madras. The Governor-general in Council, therefore, is wholly unable to pronounce an immediate judgment on the local question, and he desires to acquaint the Government of Madras with the cause, in order that it may not be supposed that the Madras Railway is overlooked, or a decision upon it unduly delayed.

2d. The Governor-general in Council conceives that his consideration of it would be much facilitated by the presence of Major Pears, and he requests that that officer may proceed to Calcutta by the next steamer, if possible.

(signed) Dathousie.

No. 982.

From *J. P. Grant*, Esq., Secretary to the Government of India, to Sir *H. C. Montgomery*, Bart., Chief Secretary to the Government of Fort St. George.

Home Cons.
22 December 1852,
No. 27.

Sir,

Fort William, 14 December 1852.

I AM directed to acknowledge the receipt of your letter, No. 66, dated the 9th ultimo, forwarding a copy of the report of Major Pears, the Railway Engineer, on the result of his examination of the Ghats in the neighbourhood of Vaniambady, with the sentiments of the Right Honourable the Governor in Council as to the line of railway proposed to be adopted in the Madras Presidency.

Home Department,
Railway.

2. As the Honourable the Court of Directors have desired that the opinion of the Supreme Government should be taken regarding the line or lines of railway to be adopted in the Presidency of Madras, I am directed to acquaint the Right Honourable the Governor in Council, that the Most Noble the Governor-general of India in Council has been desirous of communicating his views on the subject with the least practicable delay.

3. But the Honourable Court has at the same time addressed to the Governor-general in Council a despatch upon Indian railways generally, which they refer for his careful consideration and judgment. The subject is of the highest importance, and of large scope, and upon the decision of it must depend the judgment to be formed regarding railways in Madras; the Governor-general in Council, therefore, is wholly unable to pronounce an immediate judgment on the local question; and he desires to acquaint the Government of Madras with the cause, in order that it may not be supposed that the Madras railway is overlooked, or a decision upon it unduly delayed.

4. The Governor-general in Council conceives that his consideration of it would be much facilitated by the presence of Major Pears, and he requests that the Right Honourable the Governor in Council will instruct that officer to proceed to Calcutta by the next steamer, if possible.

I have, &c.

(signed) *J. P. Grant*,
Secretary to the Government of India.

No. 75.

Home Cons.
14 January 1853.
No. 48.

Public Depart-
ment.

From Sir *H. C. Montgomery*, Bart., Chief Secretary to the Government of Fort St. George, to *J. P. Grant*, Esq., Secretary to the Government of India.

Sir,

Fort St. George, 23 December 1852.

I AM directed, in acknowledging the receipt yesterday evening of your letter of the 14th instant, No. 982, to state, for the information of the Most Noble the Governor-general in Council, that immediate measures were adopted for summoning Major Pears to the Presidency, and it is possible he will reach Madras in time to proceed to Calcutta by one of the two steamers expected before the close of this month.

2. Major Pears is at present on leave at Mercara, distant from Madras 370 miles: but arrangements have been made for facilitating his journey, which it is hoped will enable him to reach the Presidency by the 29th instant at latest: in the event of Major Pears being too late for the steamers, he will be directed to take advantage of any favourable opportunity that a sailing vessel may afford.

I have, &c.
(signed) *H. C. Montgomery*,
Chief Secretary.

No. 77.

Home Cons.
7 January 1853.
No. 79.

Public Depart-
ment.

From Sir *H. C. Montgomery*, Bart., Chief Secretary to Government, Fort St. George, to *J. P. Grant*, Esq., Secretary to the Government of India.

Sir,

Fort St. George, 30 December 1852.

WITH reference to my letter of the 23d instant, in reply to yours of the 14th idem, I have now the honour to inform you, that Major Pears, c.b., of the Madras Engineers, who proceeds to Calcutta by the Peninsular and Oriental Company's steam ship, hourly expected at this port, and who is the bearer of this letter, is prepared to afford to the Most Noble the Governor-general of India in Council full information regarding the projected Madras railway.

I have, &c.
(signed) *H. C. Montgomery*,
Chief Secretary.

OBSERVATIONS upon a Memorandum by Major *Kennedy* upon Indian Railways.

THE subject discussed in Major Kennedy's Memorandum of the 14th of September 1852 is one of such vast importance, both to the interests of the Government and to the prosperity and progress of the people of this country, that it cannot be too carefully considered, neither can it be too promptly determined.

2. The writer points out the immense value to the Government, as well as to the people, of a well-arranged system of railways, and proposes certain general rules, by an adherence to which, the required arrangement of that system may be effected.

3. Major Kennedy's observations and rules are for the most part expressed in general terms, and cannot, therefore, be fairly objected to when any difference of opinion may exist by reference to any individual, and it may be, exceptional case or cases.

4. I differ from Major Kennedy in many points; but I give my views in opposition to his with diffidence, not forgetting that I labour under the disadvantage of forming my opinion chiefly from books or from observations made upon matters carried on at the other side of the globe. The opportunities which I have enjoyed of seeing the practical working of railways have been merely such as the liberality of the Honourable Court, during a short furlough to England some years ago, afforded me.

5. Of the importance of railways in this country, whether to the people or the Government, alluded to by Major Kennedy, I need say little; there can be no doubt that their effects will be, must be, very great and beneficial, relatively

relatively than they have produced in any country in Europe; neither can the importance of laying down our lines judiciously and constructing them economically with a view to the people deriving the greatest possible amount of benefit from them, be over-estimated.

6. It is difficult, it is, in fact, impossible, to say what the exact nature or the precise amount of benefit will be; nor is it of much consequence, if men may reasonably differ as to the relative value of the social, the commercial, and the political results. It is quite sufficient we should feel satisfied, that as surely as effect ever followed cause, the introduction of the most powerful of all known physical agencies, that by which rapid, safe, and cheap communication between the different parts of the empire is at once provided, must lead to great results. Its operation upon the minds of the people is enough of itself to ensure all the rest, and great as may be the consequence of a large saving in the carriage of men and goods from point to point, the spread of science and education will effect still more in promoting the material as well as the moral well-being of the people.

7. I believe these, the indirect results of the operation of railways, inestimable as they are, to be by far the most important. I believe the best interests of Government to be identified with those of the people, and I think therefore, as I have elsewhere observed, that "We are in danger of doing great injustice to the people of this country, by looking upon these great works as mere commercial speculations; and, by meeting every railway project with the condition that it shall at once pay its own expenses, together with the interest of the money laid out on its construction."

Report, 5 March
1851, Para. 41.

8. There are, however, direct savings in money, which may be estimated with more or less of exactness. Applied to military purposes, the savings to Government effected by the railways would be great. In moving troops on occasions of ordinary periodical relief, in the conveyance of Ordnance and Commissariat stores, an annual saving to a large amount would be effected. There would be little difficulty in making, from the returns of the several departments for a series of years, an approximate calculation of what this saving would be: the same returns would show the number of miles of railway necessary to provide for all these reliefs. I am inclined, from our experience in the south of India, during the last 30 or 40 years, to value above all these advantages the saving of life. Movement of troops in that part of India is so frequently attended by, and so commonly appears to give rise to, epidemic cholera, as to give grounds for just apprehensions of its appearance in all such cases. The frightful loss of life on such occasions is not confined to troops and followers, but the unfortunate inhabitants along the whole line of march come in for their share of suffering and death. An instance came lately under my notice of a native corps in the Madras Presidency making a march of about 400 miles across the Peninsula, carrying the disease with it during a great part of the way, tainting every village on its course. I cannot think it an exaggeration to estimate at several hundred lives the cost of that march from coast to coast; a steamer would have brought the regiment round in a week; a railway would have carried them safely across in one day. If we wish to form some more definite idea of the saving in money to be effected by these works, we cannot do it better than by calculating the difference between the cost of carriage for a known amount of produce by the present roads, and that by a railway over the same extent. Assuming the moderate amount of 50,000 tons to pass annually over any given 500 miles of road, and saying nothing of the loss of time, the risk of injury done to the goods, two annas per ton per mile may be taken as a fair average charge for land carriage at the present time. If the charge per rail were one anna (and I consider this a maximum), the saving in hard money to the people concerned on the supposed line of road would be 15 lacs of rupees per annum. Major Kennedy proposes to begin with nearly 6,000 miles of rail, the saving upon which at this rate would be 180 lacs of rupees annually. It is not possible, to say nothing of the great benefits arising from the improved means of personal communication, nor of the mode in which a reduction in the charge of transport and an increased amount of traffic, are with respect to each other, both the cause and effect,—it is not possible that the removal of these great present burdens on the raw produce of this country, could fail in giving a great stimulus to production, raising the general condition

of the people, increasing the demand for European manufactures, and telling most beneficially upon the public revenues.

9. It might be considered an uncalled-for extension of this paper, were I to discuss the effect to be anticipated from the establishment of railways on the strength and efficiency of the army. That they must greatly contribute to promote vigour and efficiency in all our military arrangements and operations, there can be no doubt; but considering the position and duties of the great mass of the force, and the very small portion that can be considered as a reserve, solely required for purposes of foreign war, I confess that Major Kennedy's estimate of the possible reduction in our standing army, as the immediate consequence of the railways, appear to me very greatly overdrawn. The operations of railways are essentially peaceful; they have arisen out of, and naturally belong to, an era of peace, civilization and commerce, and their maintenance and use as a means of communication appear to be in a remarkable manner dependent upon the will and pleasure of the people: although, therefore, they greatly tend to facilitate the preliminary arrangements for aggressive war, and perhaps, though in a far less degree, contribute vigour and efficiency to preparations of a defensive character, we cannot with any safety calculate upon them in the case of active operations within our own frontier, or venture, in reliance upon them, to reduce materially our garrison. They will, we may hope, though indirectly and remotely, affect the strength of the army by so operating upon the character and pursuits of the people as to render so large a body of disciplined troops unnecessary.

10. I shall now make observations on the rules proposed in the 31st paragraph of Major Kennedy's memorandum, for our guidance in the arrangement, construction and working of Indian railways; but before doing so, it is necessary to say something on the important subject of gradients generally. The subject is doubtless an important one, but the questions which arise out of it, seem to me in almost all cases to admit of easy solution. It is easy to propose a rule, fixing the maximum slope at which lines of rail shall be laid down in this or any other country, but it is hardly possible that such general rule could be acted upon in every case with a due regard to the interests of the country.

We may give up a project in obedience to the rule, where its application would be impracticable, or we may apply it at an inordinate expense, but since nature has liberally given certain gradients to work upon, and since each project for the establishment of railway communication between two points will have its peculiar characteristic features, the only general rule that it seems safe to adopt, is to take care to make the best of each particular case.

11. I attempted in my report of the 5th March 1851 to lay down a rule of this kind in the following words:—"The first thing to be done in projecting a railway is, to ascertain the nature and amount of work likely to be required of it; the next, is to make such arrangements in the construction and subsequent maintenance of the work, that the whole annual charge, including interest on capital, and working expenses, may be a minimum. The resolution of this problem," I observed, "will determine every important point connected with the subject, as the question of single or double line, the character of the slopes (gradients), the size and power of engines, and the weight of rails."

12. The subject of gradients, intimately connected as it is with other circumstances in each particular case, may be viewed for the present under two different aspects. The first is, that under which it is most commonly considered, viz., as affecting undulating lines, lines wherein there may be little or no difference in point of elevation between the two termini; in which, therefore, every undulation involves the necessity of lifting the load a certain height beyond that which is ultimately aimed at, since the load which can be moved at the same cost of power becomes less nearly in direct proportion to the rate of rise in the gradients; and since it is known that in undulating lines the saving on the down runs does not compensate for the additional power required at the ascents, it is evident that such lines must be more expensive to work than one uniform plane between the termini. It becomes, therefore, a question in each case, whether the interest on money required for the reduction of these undulations, is or is not more than the extra expense involved in working over them. Among the points that would enter into a calculation of this kind are, the nature and amount of traffic, the extent to which it is likely to be augmented, the direction of the greater portion, the physical characteristics

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of the line, the cost of materials and labour. We can hardly lay down any general rule for cases which involve so many varying elements. It is important to observe, the more so, as we have had no experience yet in India, that the extravagant cost of some of the lines in England alluded to in Major Kennedy's 24th paragraph, though by no means wholly due in any, and in the most striking cases, not even chiefly due to any faults of the engineers, were, to a certain extent, attributable to a desire to obtain the best possible gradients. An opinion seems now to have become almost universal, among the most distinguished practical men, that this was an error. All the later lines are constructed at a much cheaper rate; first cost is much reduced by admitting and working, at an increased expense, gradients that some years ago would not have been tolerated.

13. But this question may be considered in another and totally different aspect. We wish to establish railway communication between two important localities; though they are but 200 miles apart, nature has placed one 2,000 feet higher than the other. We will assume the possibility of laying down a line upon a continued plane from point to point: the gradients would be one of 10 feet in the mile, or one in 528, the length of line 200 miles. Now, in many cases, it might be perfectly practicable to construct a railway between two such points, with a uniform gradient of 1 in 2,000, but then the line must be upwards of 750 miles long. This may appear an extreme case, but it serves the better to illustrate a subject which, in practice, often becomes a fair matter of inquiry. We shall have to consider the cost of the two entire lines, the nature and amount of traffic, the direction of its chief portion, whether up or down, the districts through which each line would lie, the advantages to be gained or conferred by the railway from or upon those districts. It is obvious, without any detailed calculations, that assuming the cost of construction per mile, and all other things, alike, there could be no comparison between the two lines above described, and no hesitation in choosing the shorter and steeper. It seems, then, that a gradient on a railway must ever be considered, like any other expedient, as a means to an end; its cost taken into consideration, its applicability on each particular case of difficulty.

RULES proposed by Major Kennedy.

1st Rule.—That all railways constructed in India shall belong to one of two classes, the first or second class.

14. Nothing can be said upon this rule till we see how these two classes are defined.

2d Rule.—That the regulating gradient of the first class, or trunk railway, shall not exceed 1 in 2,000. By "regulating gradient," is meant the gradient which shall regulate the load of the engine.

This rule may be understood to mean either that railways with such a ruling gradient, and they alone, shall be called first class, or that none of the trunk railways, properly so called, shall be constructed at all unless such a gradient be attainable. Looking at the next rule, we may perhaps, without error, attach to this the former of these meanings, and assume that Major Kennedy has applied the term "trunk," commonly used to indicate the importance of the direction and amount of traffic, to denote the characteristic gradients of the railway.

In taking this meaning and following this rule, we should have to place all our railways with a ruling gradient not exceeding 1 in 2,000, among the first class as trunk lines. I think, however, that this application of the word "trunk" is likely to create some confusion. It is an old practice among engineers to class their railways in this manner, according to the gradients: a mere professional distinction; the word "trunk" is, in common language, generally applied to those roads or lines of railway which lie in the direction of the greatest traffic and importance. No trunk line, so understood, could be constructed within the Madras Presidency, with such a ruling gradient as this, unless by increasing the length of the line to an extravagant extent; in many cases even this would fail to effect it.

3d Rule.—That no regulating gradient of any second class or branch railway shall exceed 1 in 330.

As there are but two classes proposed, this rule may be otherwise rendered thus: that no railway shall be constructed in India having a ruling gradient of more than 1 in 330, or 16 feet to a mile. Now, although the application of this rule would be attended in many cases with much less difficulty than that of the former, I apprehend it would be found, in the south of India, that, with the exception of lines parallel to the coast, or running but a few miles from it, none could be constructed with advantage without a departure from this law. If we cast our eye over a map of Southern India, we find that a line drawn up the middle of the Peninsula will pass over towns and districts at heights above the sea, varying from 1,200 to 3,000 feet; these represent the heights of the several portions of a table land which forms the greater portion of the Peninsula, and is bounded by lines of Ghauts running nearly parallel to, and at varying distances from, each coast. The rise to these plains from the sea is in no case uniform; for some miles from the sea it is always slight; it is subsequently quickened either by a line of abrupt Ghauts, or through chains of hills, forming a succession of valleys, which rise rapidly till they reach the average elevation of the table land. There is but one line between Bombay and Cape Comorin where the Peninsula can be crossed, without passing one or two chains of Ghauts; that line would pass from the eastern coast at or below Madras, by Paulghat to Ponany or Calicut. Even upon this the gradients proposed in this rule could not, I fear, be maintained throughout its whole length. I will take Bangalore, a large and populous town, and most important military station, as an example of a place which it would be impossible to approach, except by a most circuitous route, with anything like compliance with this rule. It is 3,000 feet above the sea, and 200 miles from Madras, but the direct line is broken by the Ghauts, which rise abruptly to a height varying from 400 to 1,000 feet. There is no way of avoiding these Ghauts, unless we can get (which is doubtful) through Cuddapah to Bellary, and thence back to Bangalore, making the distance from Madras to the latter place five hundred miles instead of two. Knowing these circumstances, the questions are, is it desirable to establish railway communication between Madras and Bangalore? If it is, how and in which direction can the line be laid down, so as to confer the greatest amount of benefit upon that part of the country and its inhabitants? The direct line between those two places may be described as consisting of three parts; the first, a plane with comparatively gentle ascent for 120 miles; the second, a steep incline for four miles; the third, a plane again for 80 miles. Now, assuming (for I am not here speaking of an undulating line) that we do not lift our loads in the aggregate more than 3,000 feet, ultimately aimed at, it seems probable that this natural section of the country is more favourable to the operations of a railway than a continued plane from end to end of 15 feet in a mile would be. The through traffic only is lifted the 3,000 feet, and much of the short traffic is confined to the two planes, upon which the rise is much less than the average upon the whole line. This concentration of the chief part of the rise, which enables us to apply special means to overcome the resistance of gravity, is advocated by many, as the best mode of overcoming a difference of level between two points. The effect of such an incline upon the cost of transport is easily calculated. I will suppose that the cost (locomotive expenses) of moving a ton along the first 120 miles is one farthing per mile; that the cost for the last 80 miles is the same; and that upon the incline is four times as much, or one penny per ton; we should have the cost for the whole distance—

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just threepence more upon the 204 miles than it would be if there were no incline; and if Bangalore be 400 feet lower, a similar plane extended from one terminus to the other. If, however, the two planes and the intermediate Ghaut could be resolved into one uniform plane, we should find the cost of moving a ton its whole length very little less than the above, while the expenses on the several portions at each extremity would be greater; that is, the cost of conveying

conveying a ton along the whole length of the dotted line A B, would be little, if anything, less than along the broad line between the same points,



while the cost of the local traffic on the portions A C and B D would be more.

I conclude, therefore, with regard to these two rules respecting gradients, that none of the lines most required within the Madras Presidency could be laid down so as to comply with either, and that the question of what the ruling gradient shall be, is one that does not admit of a determination by any general rule, but must be considered with reference to the circumstances of each particular case.

4th Rule.—That short alternate impulsive planes may be introduced to assist the ascent, not to exceed a length of half a furlong each, and not to be nearer to each other than one and a half furlong.

I cannot agree with Major Kennedy in thinking that any advantage would be gained by this mode of construction. In any long-continued fall, however, there should be level planes at stations.

5th Rule.—That no line shall be undertaken when the estimated cost shall exceed the average rate of 5,000 *l.* per mile of single track. But that this rate of cost is not expected to include the bridging of large rivers, as the Soane, Jumna, &c., exceeding half a mile wide at flood level; such rivers are to be considered as breaks or temporary termini, where goods and passengers are to be carried across on rafts.

This is a question, again, which appears to me not to admit of a general rule beyond this, that the cost of bridging the river, irrespective of its breadth, should be considered with reference to the risk, the expense, the delay, and the discomfort of shifting the loads and carrying them across on rafts. There are rivers in India which exceed the half mile in breadth, and which are dry for a great portion of the year, falling occasionally with a volume and velocity which make it dangerous to attempt a passage in any way. A river of this kind 1,000 yards broad might be bridged for 20,000 *l.*, and as they may be supposed to occur upon a line of railway not more than once in 400 or 500 miles, I do not think an addition of 40 *l.* or 50 *l.* per mile to the 5,000 *l.*, which the line is supposed to cost, too much for overcoming such a difficulty, and getting rid of so serious a fault in the line. The propriety of bridging a river, no matter what its width, must be determined in each separate case by the position of the river on the line, by the cost of the bridge, by the safety and facility with which the river can be otherwise crossed.

6th Rule.—That no line shall be sanctioned, except for a single track of rails, with masonry cuttings and embankments to correspond. The ground, however, required for a double track to be in all cases secured.

I have elsewhere given my opinion on this point, and perfectly agree with Major Kennedy.

7th Rule.—That no locomotive engine shall be introduced to India for 10 years, except such as the ratio between the length of stroke of piston and the diameter of the driver-wheels shall sanction with reference to the maximum load, notwithstanding any sacrifice of velocity on the journey. Rule No. 11 contains an exemption from the restriction.

This will be best considered with Nos. 10 and 11.

8th Rule.—That when piling for foundations be requisite, the foundations are to be laid to suit a double track, although the superstructure is only carried up for a single track.

I agree with Major Kennedy on this point, having made the same suggestion elsewhere.

9th Rule. That no portion of any line shall be permitted to open for the transport of goods or passengers until the capital account for the construction of such portion shall have been closed.

This we have too much reason to know from proceedings in England to be a very important matter, and it will probably require much careful treatment here as our railways become extended, whether that extension be effected through the instrumentality of one or of different companies. It may be observed, however, that there will be much less chance of the same grave errors being committed here, so long as a Government guarantee places a known limit to the amount of capital. My own opinion is, that nothing but the extension of a line, its enlargement from a single to a double track, would justify an augmentation of capital when once the line has commenced working.

10th Rule.—That no more than one train daily shall run in each direction upon any line until the traffic shall furnish more goods and passengers than one engine can carry, after which a second may start daily each way; and that when the traffic calls for three trains fully loaded per day, then arrangements shall be made for laying down a second track of rail.

This Rule may be considered with No. 7 and No. 11. The "maximum load" which Major Kennedy alludes to in No. 7, may mean either the maximum, as defined by rule, or the largest amount which the circumstances of the line may bring at any given moment. In neither case can it be determined with safety until the line has been some time in work. I understand from these rules that there are to be no passenger trains as distinct from the goods, till the dividends have exceeded 6 per cent.; but what will the public say to this? Are they to be conveyed cheap, with the luggage trains, as cattle are carried in England, so long as the proprietors' dividends fall short of a fixed sum? or would they not rather go faster, and pay higher, and thus contribute more to the realisation of those profits? In another place, para. 38, Major Kennedy deprecates indulgence in the "luxury of superfluous velocity;" but surely it would be as impolitic as unjust, for the managers of a railway to refuse to the public any velocity (within the limits of safety) for which they were willing to pay. If the Government or railway company contracted for a fixed annual payment to furnish the means of locomotion for the whole of the country, goods and passengers, it would be natural enough for them to discourage this luxury, as involving themselves in certain loss; it would be to their interest even to keep the amount of goods to be conveyed as low as possible; but constructed and worked as railways are, it is in every way desirable that they should be made to contribute to the convenience of the public in every possible manner, the charges being so arranged that every unit of work done shall bring a fair profit to the proprietors. The question of the description of engine, the number of trains, the speed, &c., will not be satisfactorily determined till the line is in work. In the mean time, some engines must be employed to begin with, and I should have preferred the lighter ones for the first experiment, to any calculated for an estimated maximum load.

11th Rule.—That, notwithstanding the tenor of Rule No. 6, if on any line it shall appear that the profits exceed a dividend of 6 per cent. per annum, it shall then be permitted, if thought advisable by the Directors of the Company interested, to introduce engines of higher powers of velocity with a view of running passenger-trains separate from goods trains.

This has been considered with the above.

12th Rule.—That the height above the sea of all obligatory points throughout India having reference to the construction of works, draining, irrigation, &c., such as the highest points or necks of valleys, the low passes in mountain ranges, be obtained and recorded with all convenient despatch on the maps now in progress of construction by the Surveyor-general's department; and that, in addition to this, the height of numerous points of inundation level to be taken upon the rivers of India, and recorded upon the maps at intervals of two or three miles, so as to admit of the protraction of proximate sections of the slope of such rivers; and that any striking peculiarity in the lines of rivers or of the ground between adjacent rivers be reported upon to the Surveyor-general by his subordinate officers; such reports to be methodically arranged in his office as records.

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On this I have no remarks to offer, further than to express my opinion that such information would be interesting, and, no doubt, on occasions, of considerable use.

15. It is, no doubt, a matter of the very highest importance that our railways in India should be laid down judiciously, and constructed and worked with the utmost economy. We have to consider the objects of each proposed line, and the difficulties which present themselves in the attainment of these objects. The first question is one for the Government to determine with the aid of those best informed upon the commerce, the population, the resources and the necessities of different districts and localities. In this country, where we are especially bound to get the utmost possible advantages out of every rupee expended on these works, we have to make our first lines serve in the highest degree all important purposes, commercial, political and social.

16. I should say, therefore, that the course to be pursued is not to begin with any general rule limiting the gradients of our railways, but to ascertain where railways are likely to be introduced with the greatest advantage, what the best line or lines to adopt, and what encouragement we can gather from a comparison of the present probable cost with the prospective benefit.

17. It only remains for me to make a few observations on the particular lines which Major Kennedy has proposed for the railways in the Madras Presidency.

18. The propriety of determining as far as possible, before we commence upon these works, the principles upon which they shall be laid down, and the course to be followed by those great lines which should constitute the frame-work of the whole, will be admitted by all; and the first question connected with this subject which suggests itself in reading Major Kennedy's paper, is this: shall our lines be laid down with reference to the physical characteristic of the different parts of the country, or to the present arrangement of the population, the agricultural, commercial, manufacturing classes?

19. The lines marked red in the map which accompanied Major Kennedy's paper, denote his proposed first-class or trunk lines; and these it is intended should have no gradient above one in 2,000. These are coast-lines from Calcutta to Tanjore, about 1,200 miles; the same from Calicut to Bombay, 500 miles. There is also one across the Peninsula from Tanjore to Calicut, about 250 miles, and another from the coast-line near Rajamundry to Surat, about 700 miles. The latter connects Madras with Bombay by a line of which the total length is about 1,200 or 1,300 miles; the distances are taken on mere approximation from the map above mentioned.

20. With my report to the Madras Government of the 5th March 1851 (para. 9) I submitted a sketch, showing what I thought were the lines likely to be considered of the first importance in that part of India; and in that dated the 12th of July following, while considering the political importance of these works, I gave it as my opinion (paras. 7, 8) that the coast-lines were of secondary importance. I am of that opinion still; they are expensive lines to construct, of little commercial value, and while we have command of the sea, of no great political importance.

21. The lines proposed by Major Kennedy within the Madras Presidency, whether for 1st or 2d class lines, seem to have been selected almost entirely with reference to the course of certain streams, and after describing the drainage of an extensive portion of the Peninsula by the Soane, the Nerbudda and Taptee, the Godavery, Mahanuddy, &c., he adds, "These (the geographical features) force upon us the knowledge of what the great arteries of commerce must necessarily be, and with those arteries our trunk roads must necessarily correspond."

22. Now, the rivers in the south are not, and never have been, the great arteries of commerce. All those rivers upon which Major Kennedy has marked lines, the Godavery, the Kistnah, the Pennaar, the Polaar and the Cavery, exhibit in different degrees the same characteristic features. They rise on the table land (some at the crest of the Western Ghauts): they pass over it, by a course more or less circuitous, till they reach the eastern limits of that table, and they then plunge on to the Coromandel plain, either falling over abrupt Ghauts, or

by a turned and very tortuous course among an uninhabited or very thinly peopled range of rugged hills covered with forests; some of these rivers are dry during a great portion of the year, and all are subject to very great variations in their volume of water.

23. It is manifest that such streams as these cannot affect the condition of the people or the country as to the Ganges, the Indus, and the Nile. In the Ganges we see a large volume of water all the year round, serving as a great highway for the people; a broad fertile valley, subject annually to the fertilising influence of this noble stream, and the people clustering in large numbers on its banks, exhibiting in every possible way their appreciation of the benefits they receive from it. Here, then, we have a great artery of commerce, and we must recollect it has become so not merely because the country drains down the valley, but because that valley and the stream which flows down it are favourable to the ordinary commercial manufacturing and agricultural pursuits of mankind. The traffic to which the railway company look for their dividend is greatly due to the river in its operations as a highway. We may take encouragement from this in other parts of the country where the traffic is now less, and trust that, denied as they have hitherto been the great advantages of cheap transport, the railways may do for them what the Ganges has done for Bengal.

24. The Mahanuddy, the Godavery, the Kistnah, are rivers, as I have above shown, of a different character. Instead of being the great arteries of commerce, no populous or busy towns are found on their banks during their whole length. Instead of passing through a dense and industrious population, their course for several hundred miles lies through a region of mountain and forest, where the sound of man's voice is never heard; a great portion of which has never been surveyed or explored. It is to be observed that the principal lines here shown are not drawn with primary reference to Madras, the southern capital, but fall upon the coast at Coringa and Masulipatam, leaving a coast line of 200 and 300 miles to be traversed in order to reach Madras. We may believe that Madras, with the large amount of capital invested in its fortress, and its public and private buildings, its 700,000 inhabitants, is wrong placed; but can we venture thus far to act upon our belief to consider it as of secondary importance in our railway arrangements?

* Para. 19.

25. Of the second-class lines, two run nearly parallel to each other, and to the first-class lines above mentioned;* they constitute in fact trunks having no connexion with each other. Three lines from coast to coast are thus laid down: one starts from Masulipatam, follows up the Kistnah a few miles, crossing over the intervening high land by Hyderabad, falls on the Godavery, which it follows, to the vicinity of the Western Ghats; the other starts from the same point, Masulipatam, and continuing to follow the Kistnah, passes by Kurnool in the ceded districts, up the valley of the Beema to Poonah. The latter portion of the line (from Bellary, instead of Kurnool) is that which I propose as the continuation of a line from Madras (not from Masulipatam) to Bombay, whenever such continuation is thought advisable. Another second-class line marked on the map is from Madras to Bangalore up the Ghats. The last to be noticed is one from Trichinopoly to Seringapatam, of which I see no advantage; the line to Bangalore having already brought the rail to within 80 miles of Seringapatam; a continuation of which would throw the latter place into direct connexion with Madras, avoiding a second Ghant between Seringapatam and Trichinopoly.

26. I think, then, that Major Kennedy is in error in acting upon the assumption that the lines of drainage in any country necessarily constitute the great arteries of commerce. The line of a large navigable river, flowing through a broad and fertile valley, will become, of course, a great artery of commerce, created, fostered and carried on by itself; but apart from the fact that the line of a navigable river is not that which, as a general rule, we should choose to begin railway operations in a country elsewhere without any means of communication, I think it will be found, in those countries where railways have been already established, that the great arteries, whether discovered or established by the railways, do not lie down the drainage in all cases,—in some, lie directly across it.

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27. One more observation may be made upon this point; viz., that these streams do not necessarily give us good gradients, unless by a sacrifice in length and straightness. If we take any plain, such as that of Coromandel, inclined generally to the sea, at such an angle that a direct line drawn across it perpendicular to the coast would fall 10 feet in a mile; the general course of a river will have precisely the same fall, and it is only by following the numerous sharp sinuosities of the river, and so proportionately increasing our distance, that we could reduce the fall to that of the river's bed.

28. I conclude this paper, already I fear much too long, with the following summary:—

1st. Our lines are to be laid down, I think, with reference to the existing state of the country, the commerce, the population, the resources and necessities of the several districts and localities; not with reference to the physical characteristics of particular lines of country.

2d. We have to bear in mind that the profitable permanent working of a line, alluded to by Major Kennedy in the 50th para., depends upon the amount of traffic, the length, the original mileage cost, no less than upon the gradients; and that a line laid along a river may, and certainly would, in some of these cases, be a very expensive one.

3d. A short line with steep gradients may be a cheaper line to work, as well as to construct, than a longer one with easier gradients; it may also lie through more profitable districts.

4th. When for political purposes we desire to connect by a railway two distant termini, we should try to make the most out of the line, not lay it down with the sole view to communication between those points; but, as it were, coax the traffic of the country by seeking the more important localities adjacent of its general direction. "Direct lines will come in their turn, when those first made will take their proper places as valuable, though it may be then subordinate members of the entire system."

5th. In the case of navigable rivers, and such as the Godavery, which it appears probable might, at no great cost, be rendered navigable, that part of the country to which they already furnish a cheap and ready means of transport may, as a general rule, be left without railway, till the more pressing necessities of other portions of the country have been provided for.

Report to Madras
Government,
12 July 1851.

29. I have only further to remark, that the line proposed on the eastern coast of Madras lies over a country singularly favourable for the construction and supply of canals. The construction and working of a canal near Madras, so short as to produce little effect on the development of traffic, has been attended with very favourable results. A proposition has been made, and, I believe, sanctioned, for extending it a few miles; and there is no doubt that communication by canal might be opened along the coast between the now fertile deltas of the Godavery and the Cavery at a far less cost than a railway, and far more capable of competing with the present cheap coasting traffic.

30. Should the Government determine upon taking into serious consideration any grand trunk line or lines, such as that proposed between Bombay and Agra, I would suggest that preliminary inquiries be made for the purpose of obtaining what may be called information in the rough from civil and political officers employed in the intervening districts, as to the probable political effects, the nature and amount of traffic, and the course which the general features of the country seem to point out. Documents containing information of this nature, placed in the hands of an engineer at starting, would direct his attention at once in the right way, and save a good deal of time, labour and expense.

Calcutta,
1 February 1853.

(signed) T. T. Pears, Major,
Madras Engineers.

No. 13.

From Sir *H. C. Montgomery*, Bart., Chief Secretary to Government, to
J. P. Grant, Esq., Secretary to the Government of India.

Sir,

5 February 1853.

Public Department.

WITH reference to my letters of the 23d October, 9th November and 23d December last, I am directed to state, for the information of the most Noble the Governor-general of India in Council, that Mr. Smalley, the Agent to the Madras Railway Company, has reported his arrival on the 31st ultimo, and that this Government awaits the decision of the Government of India regarding the direction of the line to be followed, to permit of the orders of the Honourable Court, quoted in the margin,* being carried out.

I have, &c.
 (signed) *H. C. Montgomery*,
 Chief Secretary.

No. 164.

(No. 75.)

From *J. P. Grant*, Esq., Secretary to the Government of India, to Sir *H. C. Montgomery*, Bart., Chief Secretary to the Government of Fort St. George.

Sir,

Fort William, 4 March 1853.

Home Department,
Railway.

I AM directed by the most Noble the Governor-general of India in Council to acknowledge the receipt of your letter, dated the 5th ultimo, No. 13, reporting the arrival, at Madras, of Mr. Smalley, the agent of the Madras Railway Company.

2. Major Pears, with whom, whilst in Calcutta, the most Noble the Governor-general communicated personally on the subject of the Madras Railway, and who, before his departure, was put in possession of his Lordship's views on the questions under consideration, returned to his Presidency in the steamer of the 6th ultimo.

3. The Governor-general in Council is not prepared at present to decide positively upon the general line which the railway now to be made should take. The south-westerly line, from Madras by Menil to Vaniembady, to be ultimately extended, by Salim and Coimbatore, to the West Coast, is admitted to be one of the lines which is essentially required in any good railway system for the Madras Presidency. As far as Vaniembady, the line presents all the engineering facilities that can be expected; and beyond it, with the exception of one pass, which is not expected to be a serious obstacle, no engineering difficulties are anticipated in the whole course of the line. Even when made only to Vaniembady, it is the expectation of the Madras authorities that the line will pay as a commercial speculation; and when completed throughout, uniting, as it will do, the two coasts, nearly approaching the great sanitarium on the Neigherries, and affording a ready means of communication between the troops on either side of the Peninsula and those in the Mysore country, it will add to its commercial advantages the character of an admirable line in a political and military point of view. In this view, which, in the opinion of his Lordship in Council, in a railway constructed under a Government guarantee, should never be lost sight of, the advantages of the line will be greatly enhanced, if the new pass up to the table land near Vaniembady, discovered by Major Pears, is found upon survey to afford, as it promises to do, the best known line for a railway from the low country to Bangalore, and the table land generally.

4. On the other hand, the line to the top of the Palmanair Ghaut, to which, upon the whole, the Madras Government are inclined to give the precedence, on the supposition that it will be immediately extended to Bellary or to Bangalore, or to both places, promises many advantages; but, as compared with the other, it is not wholly free from objections. Amongst the objections are the
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* Upon the arrival of the railway company's agent or chief engineer, we desire that you will adopt immediate steps, in co-operation with either of those officers, for the early commencement of operations.

ascent of a severe Ghaut to a height of 2,100 feet above the sea, part of which ascent will be lost in descending again to Bellary; and the circumstance that, in opening up the Bellary country, this line would fail to benefit the Cuddapah district, between which and Madras at present the trade is shown by the papers before Government to be very much greater than the existing trade between Madras and Bellary.

5. It is obvious that if such a line be feasible, by far the best line to Bellary, in every point of view, would be one through the Cuddapah district. Now, although access to the Cuddapah district is known to be very difficult, the Governor-general learns from Major Pears that we are not in a position yet to pronounce absolutely against the feasibility of such a line, no survey with such an object having been ever made. In the present state of our information, therefore, the Governor-general in Council is of opinion that nothing should be done which would commit us to the adoption of any other line.

6. As far as Menil, the Governor-general understands that the line recommended by the Madras Government is the best line, whether considered simply as a part of the Vaniembady line, or as a trunk line common to the Vaniembady line and the Palmanair line. Whether the Palmanair line be determined upon or not, the line recommended as far as Menil will be part of a line admitted on all hands to be essential to a good railway system for the Madras Presidency, and one of the importance of which, in a political and military view, the Governor-general in Council is convinced. His Lordship in Council therefore authorized the immediate construction of the line proposed from Madras to Menil.

7. In the meantime, he requests, with reference to the Vaniembady project, that a line be fully surveyed and estimated for up Major Pears' new Ghaut near Vaniembady, from the point where a line from Bangalore would join the low country line to the level of the table land above the Ghaut; also, that a general survey be made of the line beyond Vaniembady, by Salem and Coimbatore, to the Malabar Coast, including a short branch from the neighbourhood of Coimbatore to the foot of the Neilgherry Hills. Further, he requests, with reference to the other object in view, namely, the attainment of Bellary, that such a survey of the country be made as will set at rest the question of the practicability of a line from Madras to that place, through the district of Cuddapah.

I have, &c.
(signed) *J. P. Grant*,
Secretary to the Government of India.

No. 23.

From the Chief Secretary to Government of Fort St. George to the Secretary to the Government of India.

Sir,

Fort St. George, 22 March 1853.

1. I AM directed to acknowledge the receipt of your letter of the 4th instant, No. 164, and to state, for the information of the most Noble the Governor-general of India in Council, that the authority therein conveyed for commencing a line of railway, to be carried as far as Menil, and his Lordship's general views on the subject, have been communicated to Major Pears, and the agent of the railway company; and that Major Pears has been requested to propose his arrangements for early carrying out the instructions of the Government of India, regarding the survey of the lines denoted in para. 7 of your communication.

Public Department.

2. I am at the same time desired to submit copies of the correspondence noted in the margin,* and of the orders issued thereon, which will acquaint the Government of India with the arrangements that have already been sanctioned by this Government for the early commencement of railway operations, and for the

* From Major Pears, c. n., dated 16 February 1853; Extract Minutes of Consultation, 4 March 1853, No. 207; From Major Pears, c. n., 12 March 1853; Extract Minutes of Consultation, 22 March 1853, No. 289.

the survey of a line to Bellary, through the Cuddapah district, and of the Pass from Vaniembady to Coopum, leading to Bangalore, and to state, that the Right honourable the Governor in Council has appointed Major Pears to be "Consulting Engineer for Railways" at this Presidency, and with reference to the salaries paid to corresponding officers at Calcutta and Bombay, has authorised that officer, in anticipation of the sanction of the Supreme Government, to draw, while so employed, a consolidated allowance of (2,000) two thousand rupees per mensem; a proceeding which he trusts will receive the approval of the Governor-general of India in Council.

3. Major Pears has been authorised to entertain for the present the establishment, to the extent marginally noted, for which also the authority of his Lordship in Council is solicited.

	<i>Rs.</i>
1 Writer - - -	50
1 Second Writer - -	25
2 Peons, at 7 rupees each -	14
2 ¹ / ₂ Lacers - - -	14
Total - - -	<u><i>Rs.</i> 103</u>

I have, &c.
(signed) *H. C. Montgomery,*
Chief Secretary to the Government of
Fort St. George.

From Major *T. T. Pears*, C. B., Engineers, to the Chief Secretary to Government,
Fort St. George.

Sir,

Madras, 16 February 1853.

Para. 1. WHEN reporting to you in person my return from Calcutta, I had the honour of communicating, for the information of Government, and by command of the most Noble the Governor-general, his Lordship's views regarding the proposed Madras Railway. I had been instructed at the same time to state, that a communication will be made upon the subject in the usual manner, so soon as the press of business connected with the English mail then under despatch admitted of it.

2. As you have been good enough to make known to me the intention of the Right honourable the Governor in Council to confer upon me the important office of the Government Engineer in the Railway department, I beg to submit a few observations upon the work that appears to be immediately before us.

3. I understood his Lordship the Governor-general to be of opinion, that while the construction of a line of railway as far as Menil appears under any circumstances desirable, its prolongation thenceforward by the projected line of Palmanair depends mainly upon that being the best line that could be discovered to Bellary; since, if a practicable line of this latter place could be found by Cuddapah, the Palmanair Ghaut might be given up, and a very convenient line to Bangalore found from Vaniembady by the pass mentioned in my report of the 27th October 1852, para. 13. A trunk line to Vaniembady 120 miles in length, would thus serve both for an extension to Salem and the Malabar coast, and for a line to Bangalore.

4. In approving, therefore, of the immediate commencement of the line to Menil, his Lordship considered that the determination of its course beyond that point might be left until an inquiry had been made into the practicability of reaching Bellary by Cuddapah, into the character of the above-mentioned pass from Vaniembady to the Mysore country, and also into the nature of the country lying between Vaniembady and Salem and the Western Coast.

5. I was given to understand that Mr. Bruce, the gentleman who has been appointed Chief Engineer of the Madras Railway, would leave Calcutta by the steamer of the 6th proximo; a difficulty in finding any one qualified to take charge of his present office having prevented his leaving sooner.

6. Upon his arrival at Madras, measures may at once be adopted for laying out the line, obtaining possession of the land, and commencing active operations between Madras and Menil.

7. With respect to the surveys, I have been informed that the Honourable Court have determined that all surveys upon lines allotted to any railway company shall be carried out (under the general direction of the Government Engineer) by the engineers of that company.

8. Apprehend

8. I apprehend that it cannot now be determined what line shall be allotted to the Madras Railway Company, whether that by Palmanair, or that by Vaniembady to Salem, or both. It may be assumed, however, that a line to Bellary by Cuddapah (should such be found practicable) will be kept distinct from any line by Menil, either to be made over to a separate company or executed by Government, and the survey in that direction must therefore be made by Government servants.

9. Should such a line prove practicable and expedient, the present company will, I presume, take up that to Vaniembady, Salem, and the other coast, which will leave in their hands the survey of the line from Menil to Ponany or Calicut, a distance of about 375 miles.

10. I purpose, pending Mr. Bruce's arrival, to take a look at the Ghauts about Naggery, between this and Cuddapah, and have instructed Surveyor Oliver to proceed to Vaniembady and survey the pass in that neighbourhood as far as Coopum. My time and attention will be necessarily too much occupied with the commencement of active operations near Madras to admit of my taking in hand the survey through Cuddapah, even with the aid of a surveyor; and I trust therefore the Government will be pleased to place at my disposal some qualified officer to conduct, under my directions, this survey as far as Bellary, or until his reports may show the scheme to be impracticable. What assistance such officer would require I cannot at this moment say, but I should think that one assistant surveyor in addition to the ordinary establishment of an assistant civil engineer would be sufficient.

11. I would take this opportunity of observing, that although this application is made in reference to a particular line, and therefore for a temporary purpose, it seems to me very desirable, when once the construction of railways has commenced, that a Government Railway survey department should be constantly at work, making upon such lines as the Government may consider deserving of attention these preliminary surveys or reconnoissances, being in fact the pioneers of the railway executive bodies. Taking the work of examination thus in time, the establishment need be neither large nor costly, while if the work is conducted by an active intelligent officer, possessed of a fair share of professional skill, its performance will greatly tend to economize both time and money, in subsequently putting the executive officers at once upon the right course. We might hope, too, by thus deliberately and thoroughly examining the country beforehand, to avoid many of those errors which have in so many cases been found to result from these preliminary proceedings being undertaken too late. Considering the great extent of country and the imperfect acquaintance that we have with many parts of it, such careful examinations seem to be more necessary here than they would be in any country in Europe; they should be carried on, too, if possible, not only upon any line where it may be proposed first to lay down the rails, but even far a-head, until means are obtained for determining the proper course for the line between the two ultimate termini.

12. In illustration of my meaning I would observe, that in laying down a line from Madras to Bellary we furnish the country with a most important work; but Bellary is not the ultimate destination of the line, and it would hardly be safe (so long as any political importance is attached to a trunk line from Madras to Bombay) to carry such a line actually up to the vicinity of the town of Bellary, until we have formed a tolerably correct notion of the course it would have to follow on towards Bombay.

13. It appears that when once a few miles of railway have been completed and brought into operation, a desire for their extension will become general and urgent, and it would be well to be in some measure prepared at once to point out the best lines for the purpose.

14. The first lines to be examined (for I should propose little more than an examination) would be that from Madras to Bellary; thence towards Bombay, those from Vaniembady to Calicut and to Bangalore, and one from Palghat-cherry to Negapatam.

15. Should it be determined to await no longer the result of "experimental" lines, and to adopt at once measures for constructing the principal trunk lines across the face of the country, the remarks which I have now ventured to make

upon the expediency of having a railway survey continually in advance of the works themselves, will, I trust, be considered not undeserving of attention.

I have, &c.
(signed) *T. T. Pears*,
Railway Commissioner.

No. 207.

Resolution of
Government, dated
4 March 1853.

Financial De-
spatches, 24 No-
vember, No. 20,
of 1852.

Para. 1. MAJOR PEARS, C. B., having reported his return from Calcutta, and offered certain suggestions for giving effect to the orders of the Honourable Court of Directors, and of the Governor-general of India, with respect to the Madras Railway, which it appears it is decided is to be carried at first to Menil, and as Mr. Smalley, the Railway Company's Agent, has already arrived, and the arrival of Mr. Bruce, the Company's Chief Engineer, may be shortly expected, the Right honourable the Governor in Council considers it highly desirable to make all preliminary arrangements possible, so that no delay may occur in the commencement of operations as directed by the Honourable Court, so soon as the instructions of the Governor-general of India in Council shall have been officially communicated. He accordingly resolves to appoint Major Pears to be "Consulting Engineer for Railways," and with reference to the salaries paid to corresponding officers at Calcutta and Bombay, to recommend to the Government of India that this officer be allowed to draw, while so employed, a consolidated salary of (2,000) two thousand rupees per mensem; and in anticipation of the approval of the Government of India, he authorises that amount being passed to him from the 1st January last.

2. The Right honourable the Governor in Council considers that the views of the Honourable Court, with regard to the exercise of the supervision and control of railways, will be best carried out by adopting the practice which has obtained in Bengal, and is reported to have been found to work well, and to answer the ends contemplated by the Honourable Court, of making the "Consulting Engineer" the medium of communication between the officers of the Railway Company and the Government; and he, therefore, determines to request Mr. Smalley, the Company's Agent, to correspond with the Consulting Engineer, through whom he will receive the orders and decisions of this Government on all points referred for this purpose.

3. The Governor in Council believes it is unnecessary to give Major Pears any detailed instruction for his guidance; he will only, therefore, direct that he preserve a careful record of all his proceedings, and he anticipates from his judgment, and the character of the agent, that by the cordial co-operation of all parties, the affairs of the Madras Railway will be conducted with efficiency and economy to a successful issue.

4. The Government concur in the remarks of Major Pears on the expediency of having a railway survey continually in advance of the works themselves; and under the circumstances represented in paragraph 10 of his letter, they will be prepared to place at his disposal the services of an officer, to conduct, under his directions, the survey of a line to Bellary by Cuddapah, on his selecting an officer whom he may consider qualified to undertake the duty.

Rs.
1 Writer - 50
2 Peons, at 7
rupees each 14
4 Lascars, at 7
rupees each 28

5. Major Pears, under date the 28th November 1850, was permitted to entertain the establishment noted in the margin, and the services of a surveyor were also given to him. He will now report what establishment he considers he will require to exercise the supervision of the railway affairs of this Presidency.

Rs. 92

From Major *T. T. Pears*, C. B., to the Chief Secretary to Government.

Fort St. George, Madras,
12 March 1853.

Sir,
I HAVE the honour to acknowledge the receipt of an extract from Minutes of Consultation of the 4th March 1853, in which the Right honourable the Governor in Council has been pleased to honour me, by conferring the appointment of "Consulting Engineer for Railways" in this Presidency.

With

With reference to the 4th paragraph of the same extract, I beg to report, that during my late tour, which, in the expectation of Mr. Bruce's arrival, I was compelled to cut rather short, I have examined the country towards Cuddapah as far as Baulpilly, which is about 90 miles from Madras.

The three principal difficulties encountered in constructing a road into Cuddapah occur within that distance; viz. the passes of Naggery, Warramully and Baulpilly. I had been induced, partly from common reports, and partly from my own experience in the course of a march along that road, with troops, in 1840, greatly to over-estimate the difficulties which these several passes present in the formation of a road. I now find, moreover, that the two former may be altogether turned, and avoided by a line running up from Madras by the valley of the Nawaveraw River, as far as Naglapooram, thence towards Calastry, falling into the old line of road near Circumbandy. I am now sanguine in my expectation that this beautiful and important district of Cuddapah may be entered by a railway at far less cost than I had anticipated. I feel encouraged, therefore, in proposing that a detail survey should be made of a line through that district to Bellary.

The officer whom I would propose for this duty is Lieutenant Roberts, of the engineers. The determination of the best line for a railway through such a country as this requires peculiar intelligence and judgment, while the labour involved in the work demands a good deal of personal energy. I believe Mr. Roberts to be well qualified for the duty, and have ascertained that he is prepared to undertake it with cheerfulness and zeal. As the weather is almost insufferably hot in Cuddapah during the next two or three months, and it would take some time for this officer's relief and journey, it might be as well, perhaps, if he carried the operations upon which he is now engaged to a close for the present season, and join me at the end of May, when the work ceases on the other coast, and when the climate in Cuddapah becomes more tolerable.

In case the Government should consider Mr. Roberts' services too valuable where he now is, I beg to submit the names of Lieutenants Tyrrell and Norton, of the 18th Regiment Native Infantry, both of which officers, I have been informed on good authority, are well qualified for duties of this nature. Should the Government be pleased to place at my disposal one of these officers, I beg to recommend that, in addition to the establishment of a first Assistant Civil Engineer, an active and intelligent Assistant Surveyor may be placed under his orders. In reply to the 8th paragraph of the extract from Minutes of Consultation under acknowledgment, I beg to state, that in addition to the establishment therein named, I have, since the 16th October 1851, had the service of a draughtsman sanctioned in Minutes of Consultation, under date the 9th January 1852; but that I would recommend the following as the establishment of my office, at least until some experience has been gained on the actual amount of work to be done:—

	<i>Rs.</i>	<i>Rs.</i>
1 Writer - - - - -	50	- - 50
1 Second Writer - - - - -	25	- - 25
2 Peons - - - - -	7 each	14
2 Lascars - - - - -	7	„ 14

Total - - *Rs.* 103

I propose this limited establishment for the present, from having observed that according to the system in Bengal, which has been found to work well thus far, the Consulting Engineer has the office of the Secretary to Government and that of the manager of the railway open to him, for such records as he may have occasion to refer to, and it has been considered desirable that his own movements should be encumbered as little as possible with records or office establishment. I apprehend, however, that the organization of the department cannot be considered yet final, and that more effectual means of auditing the railway accounts will require yet to be furnished to the Consulting Engineer. I would, therefore, suggest that the establishment now recommended be considered experimental.

I beg, in conclusion, to solicit the sanction of Government to the services of Surveyor Oliver being granted to me for a further period of six months. I am
787.

about to employ him in surveying the pass from Vaniembady to Coopum, and when that is completed I anticipate much advantage from being enabled occasionally to place him at the disposal of the railway officers. The assistance which, from his long experience and local knowledge, he may thus render are the more important, from the circumstance of not one of Mr. Bruce's assistants having yet arrived.

I have, &c.
(signed) *T. T. Pears,*
Consulting Engineer, Railway Department.

No. 289.

Resolution of
Government,
22 March 1853;
Letter from Board,
Department of
Public Works,
1 November 1852,
No. 704.

1. LIEUTENANT ROBERTS having been deputed by the Board of Revenue, in the Department of Public Works, to proceed to the Munzerabad Ghaut, to carry on the work sanctioned under date 16th November last, the Right honourable the Governor in Council desires that so soon as the present working season at the Ghaut is over, the services of that officer may be placed at the disposal of Major Pears, consulting engineer for railways, for the proposed survey of a railway line to Bellary through the Cuddapah district, and that an active and intelligent assistant surveyor may also be placed under his orders for this duty. The establishment of a First Assistant Civil Engineer required for Lieutenant Roberts will be entertained by Major Pears on that officer joining him.

Rs.
1 Writer - 50
1 Second writer 25
2 Peons, at 7
rupees each 14
2 Lascars, at 7
rupees each 14
Total - Rs. 103

2. Major Pears is authorized to retain the services of Surveyor Oliver so long as they may be required for the survey of the Pass from Vaniembady to Coopum, and for aiding the railway officers in their operations; and sanction is also granted for the office establishment proposed by him for the present at a monthly charge of 103 rupees.

(True Copies.)

(signed) *H. C. Montgomery,*
Chief Secretary.

Mem.—Regarding
the Madras Rail-
way.

Three printed
papers; two maps.
* See in No. 1, page 4,
Major Pears, para. 8
and 9; page 38, Mr.
Bourdillon, para. 3;
page 50, Major Cotton,
para. 4; and page 53,
Major Pears' whole letter.
† For the discussion
of the large view, see
in No. 1, page 4, Major
Pears, para. 8 and 9;
page 38, Mr. Bourdillon,
para. 3; page 50, Major
Cotton, para. 4; page 53,
Major Pears, whole
Letter.

NOTE by the Secretary to the Government of India, Home Department.

THE Madras engineers were hampered at first in their selection of lines by the experimental character which had been given by authority to the line to be made.* Till this idea of a short experimental line is abandoned, and a large view of the subject is taken, no good will be done. And now, happily, the Court of Directors have admitted this, and instructed the Indian Governments accordingly.†

No mile of railroad can claim a right to the public guarantee unless it forms part of a good national system of railroads.

The practical question as actually referred to the Government of India by the Madras Government is this: shall the line now first to be made run from Madras, nearly west, up to the Palmanaire Ghaut to the Mysore table land, or south-westerly, keeping entirely in the low country to Vaniembady towards Salem? Both lines are approved by the Madras engineers and Government; the only question raised is which should have precedence.

Both lines are proposed with ulterior objects as part of a system of railroads, the Palmanaire line in order to extension to Bangalore and Bellary, and eventually to Bombay, the Vaniembady line in order to extension to Salem, Coimbatore and the west coast. Coimbatore is a cotton country, and Bellary is the great cotton country of the south of India. From both the cotton now goes to the west coast.

The existing traffic of Madras takes two main lines, one of these for the south-westerly traffic, runs by Wallajahnuggur (Arcot) Vellore through the Amboor Valley at Vaniembady to Salem, the Burramahl and the south-east portion of Mysore. The present high road to Bangalore runs along this line. The other of these for the north-westerly traffic runs also by Wallajahnuggur through Chittoon to Cuddapah, Bellary and the north-east portion of Mysore. The projected lines are directed with the view of securing both lines of traffic respectively.

The Madras Government think that the Vaniembady or south-west line will
be

be more remunerative immediately, but they would give precedence to the Palmanaire or west line because of its greater ulterior importance.

The railway Committee selected the Vaniembady line as far as Wallajahmuggur, (Arcot) 60 miles, as being of all possible lines, of equal length, that on which the most traffic exists. Good reasons are given why this line, if resolved upon, should be produced at once to Vaniembady, 130 miles. The half million subscribed Major Pears reports will do this. The line presents no engineering difficulty and is remarkably cheap, being estimated at considerably less than 40,000 rupees a mile.

The line to Palmanaire, if not quite an equal length, will not be so cheaply constructed, having the Ghat to surmount, and the difficult country at the foot of it to get over. Palmanaire is 2,100 feet above the sea.

A very attentive perusal of all the papers and examination of the maps, after conversation with Major Pears, have led me to the conviction, that to give precedence, as proposed, to the Palmanaire line, would be very objectionable. My reasons may be thus summed up: It is only with a view to an ulterior object, viz., the Bellary extension, that the Palmanaire line is preferred. Now, no such examination of the country has been made as justifies any one in saying that the Palmanaire line is the best line to Bellary. It is about 70 miles longer than the direct line; it rises at least 500 feet only to fall again; and it misses the Cuddahpa traffic, now eight times greater than the Bellary traffic, without any equivalent. The direct line by Cuddahpa passes, it is known, through a difficult country, but it is not known to pass through an impracticable country. Till that country is surveyed, it seems to me unjustifiable to pronounce against what is obviously, if practicable, infinitely the best line for all the north-west traffic. The Vaniembady line, apart from ulterior objects, is acknowledged to be the most remunerative; it involves no engineering difficulty, and it forms part of the system which has been adopted as the great ultimate object equally with the Palmanaire line. It is true that the extension of the Vaniembady line to the west coast through the gap in the Ghats has not been surveyed, but the country is so well known to be favourable,* that no doubt could be entertained of its feasibility.

* The height of Palypacherry in the gap is only 800 feet.

The actual proposition of the Madras Government is, to have a trunk line of 48½ miles, running due west from Madras, to an unimportant spot named Menil; whence have after a travel can go south-west to Vaniembady and the west coast, and whence immediately a branch shall be made running a little north of west up to the top of the Palmanaire Ghat to be thence extended to Bangalore and from Bangalore to Bellary, or else from Palmanaire to Bellary.

The trunk line to Menil is not stated to be the best line for either the Palmanaire or Vaniembady railway. It is, perhaps, not materially different from the best line to Palmanaire, but it is admitted to be materially different from the best line to Vaniembady, as it takes the rail quite off the existing line of the south-west traffic, and away from the large towns on that line.

If there is certainly to be one railroad to the top of the Palmanaire Ghat, then a trunk line to Menil is a good plan. But if there is not to be a railroad to Palmanaire, then a trunk or other line to Menil is unquestionably a bad plan. Thus, before the direction of the first mile of railway out of Madras can be properly determined, the question, shall there be a railway up the Palmanaire Ghat, or not, must first be determined.

One great reason for the Palmanaire line is, that by producing it 80 miles west, Bangalore is reached. But this consideration, I think, should be discarded, because Major Pears has just discovered from Vaniembady itself a passage up to the Mysore table-land, that promises to be much better than the Palmanaire Ghat. A railroad from Bangalore by this passage to Vaniembady will be shorter than one to Palmanaire, and thereby the whole distance from Madras to Bangalore by rail will be very little more than it would be by the Palmanaire. The Vaniembady line will be close to the present line of the high road to Bangalore, and Major Pears thinks his pass is the one up which the high road would have been taken, had it been known to exist.*

* See in No. 3, page 3, para. 12 and 13.
† Cuddahpa and Bellary.

Two reasons in favour of the Palmanaire line only remain; first, that it will catch, below the Ghats, so much of the traffic of the Ceded Districts† as now passes the Chittoor way; second, that it may be extended in a direct line from Palmanaire to Bellary.

The first of these is only an immediate and temporary consideration, and on

such considerations the other line is admitted to have the advantage. It is maintained that Bellary must be eventually reached by a railroad, to be probably produced beyond it; and there can be no doubt that the cotton of Bellary is a great object. The making of a railroad to Palmanaire will not obviate the necessity of making one all the way to Bellary. At present the Bellary cotton goes to the west coast by very bad roads.

The second consideration is no reason at all, unless it is true that Palmanaire is the best line for a railroad from Madras to Bellary. It is not pretended that we are now in a position to pronounce that it is. Such a line would leave out Cuddapah, from which the existing traffic is estimated at 25½ lacs of rupees, whilst that of Bellary itself is only 2½ lacs. If feasible, unquestionably the proper line is through Cuddapah.* Major Pears tells me he is anxious to survey the country with this object.

The want of all information sufficient to justify any decision on a line for the north-west traffic, should not stand in the way of a railroad for the south-west traffic, about which the information is satisfactory.

The grand system of Madras railroads seems to me this :

1. A line from Madras to Cuddapah and Bellary, 316 miles.
2. A line from Madras by Vaniembady, Salem, Coimbatore, to the West Coast at Calicut, Penang or Cochin, 428 miles.†
3. A branch from north at Vaniembady to Bangalore, say 70 miles.
4. A branch from north at Coimbatore to the feet of the Neelgherry Hills, say 30 miles.

No. 1	-	316
No. 2	-	428
No. 3	-	70
No. 4	-	30
		844

The second of these lines involves no steep gradients, and will be a very easy and cheap line. When completed only to Salem, it will be so far a complete commercial line, as it will tap the centre of the Peninsula; when made throughout, it will be a complete work of the first order in a military and political view.

No. 1,026.

From *J. P. Grant*, Esq., Secretary to the Government of India, to *A. Malet*, Esq., Chief Secretary to the Government of Bombay.

Sir,

Fort William, 22 December 1852.

Home Department.
Railway.

I AM directed by the Most Noble the Governor General of India in Council to acknowledge the receipt of your letter, dated the 15th October last, No. 450.

2. In reply, I am desired to transmit the accompanying copy of a despatch from the Honourable the Court of Directors in the Financial Department, No. 51, dated 22d September 1852, and of the Memoir by Major Kennedy, referred to therein, and to request that this Government may be favoured as early as practicable with such remarks on it as may occur to the Right honourable the Governor in Council. On receipt of his Lordship's observations on Major Kennedy's paper, the Governor-general in Council will take into immediate consideration the question of the extension of the Bombay line of railway beyond Callian.

3. His Lordship in Council will perceive that Major Kennedy approves of none of the lines which have been proposed as a line to be immediately executed; the line which Major Kennedy proposes to be first made avoids the Ghauts, and runs to Surat, where it would branch off towards Agra and the East Coast.

4. I am desired to take this opportunity of forwarding, for the information of the Government of Bombay, a copy of a letter addressed to the Government of Fort St. George on the 14th instant.

I have, &c.
(signed) *J. P. Grant*,
Sec. to the Govt. of India.

* Cuddapah, 490 feet above the sea; Bellary, 1,600 feet; Adoni, north of Bellary, 1,400; Palmanaire, 2,100; Bangalore, 3,000. The distance by road from Madras to Bellary by Cuddapah is 316 miles; by Bangalore it is about 100 miles more.

† Salem, 900 feet; Coimbatore, 900 feet; Palghat, the gap, 800 feet.

No. 57 of 1,853, Financial Department.—Railway Branch.

From *H. E. Goldsmid*, Esq., Secretary to the Government of Bombay, to
J. P. Grant, Esq., Secretary to the Government of India, Home Department.

Sir,

Bombay Castle, 11 February 1852.

I HAVE been instructed by the Governor in Council to annex, for submission to the most Noble the Governor-general of India in Council, copy of a report received from Captain Crawford, the Government Consulting Engineer, before whom there had been placed the Memoir by Major Kennedy, forwarded with your letter of 22d December last, No. 1,026, on the subject of railways in India.

No. 17, dated 31 January 1853, with a Map of the Candesh Collectorate, referred to in para. 30.

2. His Lordship in Council considers that it is clearly and forcibly shown by Captain Crawford that the scheme which Major Kennedy proposes for adoption in this Presidency is not feasible.

The opinions of this Government in favour of the lines proposed by the Great Indian Peninsula Railway Company, and which were advocated in the papers submitted to the Government of India with Mr. Chief Secretary Malet's letter, No. 450, dated 15th October last, are strengthened by the facts stated and the arguments advanced by Captain Crawford.

4. A simultaneous extension of the railway system throughout India is, no doubt, desirable, while a line, such as that to which Major Kennedy's proposition more particularly refers, namely, to connect Bombay and Agra, is a line which would probably answer better for Government purposes than that contemplated by the railway company, yet it is one which appears to the Governor in Council, that a company seeking a dividend, cannot be expected to adopt; and, moreover, it is a line which, even if capable of construction, Captain Crawford shows could not be carried out by Government without alterations of the "disc designs," as they may be termed, of Major Kennedy; alterations requiring to be made after surveys and calculations that would entail a large expenditure of time and money.

5. His Lordship in Council is further of opinion, that if he were to withdraw his support from the railway company, and thus prevent them from carrying out their design until determination could be arrived at as to the propriety of constructing an account of the state of such a line as that suggested by Major Kennedy, the progress of railways on this side of India would be stayed for a long period, and the effect on capitalists at home and in this country be such, that if at a future period he had to revert to the original lines, as in all probability he would, or to other lines which he might wish to construct through the agency of a company, it would be difficult to raise the capital required.

6. Under these circumstances, the Governor in Council trusts that the Government of India will see fit to support the designs of the Great Indian Peninsula Railway Company, as set forth in the reports forwarded with the Chief Secretary's letter of 15 October last, No. 450.

7. The Government of India have already been informed,* that in the opinion of this Government, it is of great importance that the present experimental line should be at once extended, at any rate so far as to meet the general traffic of the country.

I have, &c.
(signed) *H. E. Goldsmid*,
Secretary to Government.

No. 17 of 1,853, Financial Department.—Railway Branch.

To *H. E. Goldsmid*, Esq., Secretary to Government.

Sir,

Bombay, 31 January 1853.

THE Memoir on Indian Railways by Major Kennedy, forwarded to the Government of India by the Honourable Court, and transmitted to the address of

* See Para. 4 of Letter to Secretary of the Great Indian Peninsula Railway Company, No. 448, of which copy accompanied Letter to Government of India, No. 450, 15th October 1852.

of Mr. Chief Secretary Malet, in a letter, No. 1,026, under date 22d December, embraces questions of so vast and extended importance, that it seems to me useless to attempt the discussion of many of them in a paper like the present, which must necessarily be comparatively short, even if I were in possession of the requisite documents and information, and felt myself qualified for the undertaking.

2. I propose, therefore, after some slight allusion to those matters which appear to be almost beyond my province, to confine myself to the portions of Major Kennedy's Memoir, more particularly affecting the question of railways on the Bombay side of the Peninsula; and I trust to be able to show, that the lines now selected and laid down, after so much expenditure of time and money, and so much labour and skill on the part of those employed in the operations, are to be preferred, on every ground, to that suggested by Major Kennedy, apparently, with the aid only of a map of the country before him.

3. The first 22 paras. of the Memoir allude generally to the vast influence for good which will attend the introduction of railways in India. All this, few will be found to dispute. The writer, however, appears to dwell principally upon their influence on military affairs, and the increased efficiency that will be given thereby to the army when the system is advanced to a certain point: this also will be readily granted: but when it is attempted to value in money the advantage thus gained, and to deduce therefrom with anything like precision the amount the Indian Government may at once raise as capital, or guarantee to private companies to push on the system in all directions at once, I must then confess, that the interests involved are too vast, and the questions, political and financial, much too complex, to warrant an individual in my position entering on the discussion; and it is, therefore, one of those subjects that I shall avoid.

4. Passing over for the present paras. 23 to 26 inclusive, which I shall consider in connexion with Appendix No. 3, "On opening a railway from Bombay to the table-land across the Syhadree range," to which they principally apply, we come to para. 37, which is subdivided into 12 sections of rules, by which it is proposed to govern railway affairs in India.

5. Propositions 1, 2 and 3 * suggest that railways in India shall be ranged under two classes; in the first, the regulating gradient not to exceed 1 in 2,000, and in the second class, 1 in 330.

6. Under peculiar circumstances, where the traffic of rail is all one way, as, for instance, from the mouth of a coal-pit to the shipping point, a down incline is an advantage; but under ordinary circumstances, where it may be hoped that the traffic, though possibly not equal, will be of considerable amount both ways, every one will allow that the nearer the railway can be brought to a perfect level the better.

7. Few countries, however, will admit of any considerable extent of line on a perfect level; and the more the surface of a country is varied by undulations, the more expensive does the preservation of easy gradients become. Supposing no difference of actual level to exist between two termini, still, if the intermediate country be of a very diversified character, an approach to a level line between them can only be preserved either by heavy and costly works, or, if the features of the ground will admit of it, by a very considerable extension of the line in its length, so as to follow the contour of the country. In practice, the object would probably be attained by partial resort to both methods, and then the talent of the engineer is called into play so to balance these, that, when combined with the estimated expense of working the line so completed, the best return may be given for the capital expended.

8. Railways are of comparatively such recent introduction, that many of us may remember what are frequently, though improperly, called the absurd ideas that

* 1st. That all railways constructed in India shall belong to one of two classes. The first or the second class.

2d. That the regulating gradient of the first class or trunk railway, shall not exceed 1 in 2,000. By regulating gradient, is meant the gradient which shall regulate the load of the engine.

3d. That no regulating gradient of any second class or branch railway shall exceed 1 in 330.

that were entertained with regard to the possibility of working them, not by the general public only, but by men of scientific note. It was, for instance, gravely asserted that an engine with a plain driving-wheel, acting on a plain rail, would not advance, and that the wheel would simply revolve without propelling the engine. When the contrary was shown to be the case, equally incorrect views were advanced regarding the power of ascending inclines, the rates of speed obtainable, the powers of traction, &c.; in fact, with all our boasted power of reason, railways, like every improvement in art and science, have been completely established by experiment, after a series of trials and errors.

9. The consequence of all this was, that, as is now freely confessed, enormous sums of money were sunk in costly embankments, viaducts, tunnels, &c., with a view of preserving that close approach to true level, which after experience showed to be not absolutely requisite, and by the experience all parties are now profiting in setting out new lines. For it is to be remembered that, whilst the cost lines of works must remain pretty nearly constant, especially those, such as heavy embankments and tunnels, in which the principal expense is the labour employed, vast improvements are yearly being effected in the adaptation of our native powers; and there is, therefore, the less reason to sacrifice money in the construction of costly works, which may be in a measure avoided by some increase of gradients.

10. Admitting, therefore, that the nearer the line of railway can be made to approach a true level the better, I still do not see the necessity for hampering ourselves with specific rules on the subject. It would appear quite sufficient, when a line of railway is proposed between any two places, that care should be taken that it be laid out with as easy gradients as possible, consistent with a due regard to economy in construction and working.

11. I shall say little on the subject of the 4th proposal.* The plan may possibly be a good one, where the slope of a country is very flat, such as perhaps in Bengal, Sinde, the desert between Suez and Cairo, where the intervening summit is attained by a regular and almost unbroken ascent. It is, however, hardly applicable to Western India, on this side of the summit of the Ghauts.

12. Proposition 5,† is one of those which had much better be left open for consideration in any particular case. I can see no sound reason for tying ourselves down not to undertake a line, merely because it is estimated to cost more than 5,000*l.* per mile of single line. If, on account of physical difficulties, the construction of a line to connect any two places, must necessarily cost from 8,000*l.* to 10,000*l.* per mile, surely, if the traffic between them offered every prospect of being a paying one, there is no sound reason in refusing to commence such a line, merely because it exceeds an arbitrary amount per mile.

13. The proposition laid down as the 6th,‡ is at present the rule observed on this side of India, with the exception of the short line through the islands of Bombay and Salsette, which has been laid as a double line, for reasons on record.

14. Proposition 7,§ determining the character of engine to be used in India for the next 10 years; proposition 10, relating to the number of trains daily on a line;

* 4th. That short alternate planes may be introduced to assist the ascent, not to exceed a length of a half furlong each, and not to be nearer to each other than one and a half furlong.

† 5th. That no line shall be undertaken when estimated cost shall exceed the average rate of 5,000*l.* per mile of single track; but that this rate of cost is not expected to include the bridging of large rivers, as the Soane, Jumna, &c., exceeding half a mile wide at flood level. Such rivers are to be considered as breaks or temporary termini, where goods and passengers are to be carried across on rafts.

‡ That no line shall be sanctioned except for a single track of rails, with masonry, cuttings, and embankments to correspond. The ground, however, required for a double track to be in all cases secured.

§ 7th. That no locomotive engine shall be introduced to India for 10 years, except such as the ratio between the length of stroke of piston and the diameter of the driver wheels shall sanction with reference to the maximum load, notwithstanding any sacrifice of velocity on the journey. Rule No. 11, contains an exemption from this restriction.

10th. That no more than one train daily shall run in each direction upon any line, until the traffic shall furnish more goods and passengers than one engine can carry; after which, a second may start

line; and proposition 11, relative to passenger trains, with engines of higher powers, are questions that might, I think, be left for consideration by the directors of a company when the occasion offers, and would probably be better arranged at the time, with the concurrence of Government, than by attempting to dispose of the subject by fixed rules at present.

15. On proposition 8* I have little to remark; the circumstance of any particular case would be the best guide; but I do not anticipate any extensive application of piled foundations on this side of India.

No. 27 of 1840, to
the address of Go-
vernment of India.

16. The instructions conveyed in para. 20 of the Honourable Court's despatch meet this point fully, as far as the real object of proposition 9† is concerned. As no expenditure whatever can be made by the railway company without the sanction of Government, and it is determined at the time to which account it is to be charged, the great object of preventing anything being charged to capital, which is properly chargeable to income, is attained. If the letter of this proposition were enforced, much difficulty might be experienced with Indian railways. A very large portion of the expenditure will necessarily be incurred in England, and if the opening of a line were delayed until the actual and final closing of every account at home, vast delay might occur, and the capital expended in the meantime be unproductive, Government, on the terms of the guarantee, being obliged to pay the interest agreed upon. I trust, at any rate, that this rule will not be made applicable, in its strict letter, to our present line between Bombay and Tannah. The contractor is about to claim his completion certificate, from which date his year's maintenance of the line will commence, and should the line not be worked for that period, or the greater portion of it, the contractor will make an extremely good profit out of 20,000 rupees, for which he is bound to maintain the line in working order for 12 months.

17. On proposition 12‡ I shall offer no remarks; the information alluded to, if collected and recorded, would no doubt be of great value, but is applicable to many other improvements besides railways.

18. Paragraphs 39 to 58 treat of matters of such vast political and financial importance, that I feel it would only be presumption on my part to enter, in any detail, upon such questions as the relative position of Government and the Natives of this country as landlords and tenants, or what per-centage of the revenues is applicable to public works. Even the subject more particularly dwelt upon from paras. 50 to 55 of the Memoir, the Appendix No. 1, and Table referring to Fly Sketch, No. 2, viz., the grand trunk lines for the whole of India, I feel to be a question requiring much larger sources of information than is contained in a map of the country spread before me, and at any rate, it is not one to be discussed in a paper like the present; nor, I trust, will the progress of railways in this country be retarded for the full and final consideration of such an immense subject. We may, I think, whilst laying out our lines so as to occupy such parts of the country as offer fair chances of profitable working, at the same time keeping in view the grand communications of the country, very well leave the railway system in some degree to develop itself; for as the whole
project

start daily each way, and that when the traffic calls for three trains fully loaded per day, the arrangements shall be made for laying down a second track of rails.

11th. That notwithstanding the tenor of rule No. 6, if on any line it shall appear that the profits exceed a dividend of 6 per cent. per annum, it shall then be permitted, if thought advisable by the Directors of the Company interested, to introduce engines of higher powers of velocity, with a view of running passenger trains separate from goods trains.

* 8. That when piling for foundations be requisite, the foundations are to be laid to suit a double track, although the superstructure is only carried up for a single track.

† 9th. That no portion of any line shall be permitted to open for the transport of goods or passengers until the capital account for the construction of such portion shall have been closed.

‡ 12. That the height above the sea of all obligatory points throughout India, having reference to the construction of works, draining, irrigation, &c., such as the highest points and necks of valleys, the low passes in mountain ranges, be obtained and recorded with all convenient despatch on the maps now in progress of construction by the Surveyor-general's Department, and that, in addition to this, the height of numerous points of inundation level, to be taken upon the rivers of India, and recorded upon the maps at intervals of two or three miles, so as to admit of the protrusion of proximate sections of the slope of such rivers, and that any striking peculiarity in the lines of rivers, or of the ground between adjacent rivers, be reported upon to the Surveyor-general by his subordinate officers, such reports to be methodically arranged in his office as records.

project suggested by Major Kennedy cannot be laid out and brought into action at once, the very progress of railways will probably tend, in some measure, to modify their future circumstances. I would also deprecate the attempting things on too great a scale in the first instance, and thereby risking failures and delays, which may cool the rising confidence which seems to be entertained at home with regard to India as a country for investment of capital.

19. I shall now proceed to notice the subject alluded to in paras. 28 to 36, of the Memoir, and Appendix No. 3, in which Bombay is more particularly interested.

20. It will be seen from para. 30, and also from the opening of Appendix No. 3, that Major Kennedy is not aware that the whole project for reaching the table-land of Candeish by the Malsej Ghaut route has, after a most careful reconsideration and survey of other routes, been rejected for that by the Tull Ghaut; and that there is no intention now of attempting the ascent by a "fixed engine incline of about six miles, with a gradient of about 1 in 18, or by an alternative incline of 13 miles long, with a somewhat reduced gradient." All exceptions, therefore, taken by Major Kennedy to these points, or to the branches from Alleh to Kandeish, and south-eastward to Sholapoor, are now of no force. Neither is it the intention that the grand trunk line between Bombay and Agra should pass over no fewer than four unnecessary and fierce ranges of mountains; indeed, it is no object, at any rate at present, with those in Bombay interested in railways, to look towards Agra at all. Our object is to reach the table-land of the Deccan and Candeish as speedily as possible; and this, I am fully persuaded, is provided for in the project now before Government in the report forwarded by the Railway Company.*

21. It is difficult to place in favourable contrast the magnificent projects put forward in the 31st and 32d paras. of the Memoir, viz., for establishing a railway communication between Agra, Candeish and Berar, the valleys of the Nerbudha and Soane, and west by Guzerat, Kurrachee, the Indus, &c., and the present more humble views of the railway company; the one plan being of so very general and extended a nature, and the other, comparatively speaking, so small; and, therefore, whilst not disputing the eligibility of Major Kennedy's mode for opening the communication of all those districts with Bombay, (*vide* conclusion of para. 32,) it will suffice to say, that the views of the capitalists interested in our present line are of a much less extensive description. Whether an immediate railway communication with Surat, and thence onward to Agra, is desirable or not, in a political point of view, Government will, of course, be the best judges, and, if necessary, will probably undertake the project; in the meantime, there seems to be no necessity for such interfering with the plans for an entirely different line of railway into Candeish now before Government.

22d. It will, therefore, be as well to narrow the limits of the discussion as much as possible, and with this object I will take the one point of opening up Candeish, one of our richest provinces, by railway communication with Bombay, and compare Major Kennedy's suggestions for doing this with those proposed by the Railway Company.

23d. Major Kennedy in his 31st para. writes, "The same reasoning which overthrows this project as a general trunk line between Bombay and Agra, holds equally against that portion of it intended to open an intercourse between Bombay and the districts of Candeish and Berar. On this portion of it, the aggregate amount of rise and fall would probably exceed considerably 4,000 feet, whilst by the coast we go level to Surat, and branch off by the Taptee Valley, at the slight gradient of the river, without passing any range whatever, nor would the distance by this route exceed that over the Ghats."

24. It will be observed from the Railway Extension Report,† that the proposed line has been surveyed and roughly estimated from Cullion to Munnaur, just within the borders of the Province of Candeish, and the aggregate amount of

* With Letter No. 548, dated 27 September 1852. Copy sent to Government of India, with Letter No. 450, dated 15 October 1852.

† Dated 14 September 1852. Copy sent to Government of India, with Letter dated 15 October 1852, No. 450.

of rise and fall will not be anything like the quantity named by Major Kennedy. It would be unfair to judge of the proposition in the memoir, by bringing Major Kennedy's line after entering Candeish down to Munnaur, as it would place him at a great disadvantage, by carrying him through the very worst part of the Daung jungle, and making an unnecessary bend to the southward in his line. I shall suppose, therefore, that it is intended by both lines to reach Sowda, which, situated towards the eastern extremity of Candeish and on the grand route for Central India, will admit, I think, of a fair comparison of the two lines.

25. To quote again the conclusion of para. 31, Major Kennedy writes, speaking of the intercourse between Bombay and Candeish, "by the coast we go level to Surat, and branch off by the Taptee Valley at the slight gradient of the river, without passing any range whatever, nor would the distance by this route exceed that even of the Ghats." Perhaps no stronger instance exists, than is contained in the above quotation, of the uselessness of attempting by the mere aid of a map, without personal local knowledge of a country, to set out the course of a railroad. Of the physical nature of the country through which he proposes the line to run, Major Kennedy would appear to be absolutely ignorant, for I am obliged to conclude, from the whole tenor of his Memoir, as regards the western side of India, and the Ghats in particular, that he has never visited it or them.

26. In the first place, if we take the coast road from Bombay to Surat, we find it, it is true, pretty level, but interrupted constantly by the mouths of considerable rivers, two or three of them amounting to arms of the sea, one and two miles wide. Probably, however, the inner route might be chosen, and this, it is true, would avoid the broadest portions of some of these; but even here they would interpose, in some cases, as most serious obstacles. In fact, whether by the immediate coast line or the inner route, the whole line of 190 miles in length to Surat, is open to the serious objection of directly crossing the whole drainage of the country, and that at the lowest, and consequently broadest portions of all the rivers. The line would be interrupted by ferries in certain instances, and in others these could only be avoided by heavy works in the shape of viaducts.

27. From Surat turning eastward, no great difficulty would probably be experienced through the Province of Guzerat, but at the entrance to Candeish, where the Taptee breaks through the line of Ghats, having the Satpoora hills on the north bank, and the end of the western Ghats on the south, the case is very different. At this point, where so much is expected to be gained by turning the range of hills, it will be necessary to give a general description of the country, in order that an idea may be formed of its eligibility for railway purposes.

28. In the first place, I may mention that for 70 or 80 miles along this part of the river's banks, the neighbouring country is for the greatest portion of the year deadly to all but the few scattered tribes, Bheels, dwelling in its dense jungles and ravines. I have made particular inquiries in these matters from those who have, when occasion permitted, passed through these districts; but perhaps I could not put the case in a stronger light, than by quoting a report, now before Government in the General Department, being one made by Mr. Edwards, of his survey during last year of the River Taptee, with a view to the rendering it navigable. As this report was framed with no other view to railway affairs, the incidental notices of the features of the country will have the greater weight, as being unbiassed in any degree.

29. Here then is his description of the break in the hills, through which the Taptee flows from Kandeish into Guzerat. To prevent confusion, it is to be observed that in his survey he is proceeding down the river, and we are now advancing up it; he writes, para. 10, "As we advance into the Daung jungle, the spurs from the Satpoora hills and the tail of the western Ghats converge towards the river, the banks become very high, as much in some places as 150 to 200 feet." Again in para. 12 he says, "At Purkassa, however, the jungle begins, the villages and the cultivation gradually disappear, until we arrive at Kookurmoonda, beyond which, nothing but a few Bheel huts, in clusters of three or four, and an almost impenetrable jungle, without a vestige of even a bullock track exists; the surrounding country is also rugged and hilly, and is very much infested

infested with tigers; this state of the country continues as far as Carranjeah, a distance of 75 miles." If to the above is added the fact, that the climate of this part of the country is to all, but the few savages bred in it, for the greatest portion of the year deadly, little further, I think, need be said to make it clear, that the immediate vicinity of the river must be avoided; and how far this could be done without becoming entangled in the rough ground of the hills on either side, a special survey only could determine. It will be seen from further quotations, that the river is liable to heavy floods, and that safety from them is to be found only in keeping the general level of the country; this, in a district intersected in every direction with ravines 150 and 200 feet deep, will admit of some judgment being formed of the probable costly nature of the requisite viaducts and embankments. The above is, I think, quite sufficient to show that the facilities of this route are not so great as Major Kennedy would seem to suppose.

30. But having now reached the province of Candeish, the greater difficulties no longer exist; still Major Kennedy's route generally must hold to the immediate vicinity of the river. The accompanying map of the province of Candeish will probably give a better idea of the features of the country than can be gained from a smaller one. I have laid down an imaginary route, supposing Major Kennedy to enter the province on the north bank of the river: as this, however, it may be remarked, would have entailed the necessity of crossing the Taptee somewhere within the province of Guzerat, where it is very wide, it is not likely that it would be selected by him. It will be seen that the route crosses the whole drainage of the country; the line by the north bank, after clearing the teak forest, would probably be found the more preferable; still it will be seen that it must cross considerable rivers and water-courses. Let us now see what is the character of the river and its immediate vicinity.

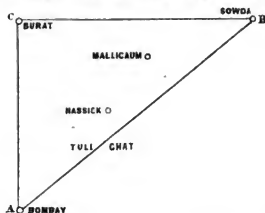
31. Mr. Edwards writes, p. 10: In the province of Candeish the banks are about 60 feet high, consisting of an upper and lower one; the upper is composed of black earth, and is on a level with the surrounding country, but the lower bank is of yellow earth, and is very much cut up into ravines. And again, in para. 13: "I think it was in a flood, 14 years ago, that several of the villages in Khandeish, which were situated on the lower bank of the river were swept away; the devastation of life and property was great, and those that had the good fortune to escape, were left destitute. I have observed, that in no instance had any village that was situated on the black earth suffered injury, whilst, almost without exception, those on the yellow earth suffered more or less, and in fact, the inhabitants have now deserted several of their old villages, and founded newer ones on higher ground." If the above had been written with a sole view to railway matters, it could not have been more to the purpose. It is clear that the railway could only be carried on in the vicinity of the river at the cost of most extensive works; but under the supposition that the line might be kept at such a distance from it, as to avoid the greatest of these difficulties, still this portion from the entrance to Candeish by the Taptee to Sowda, cannot compare with the portion from Mamnaur to Sowda.

32. The line from Callian to Mamnaur has been surveyed, and the results are now before Government. From Mamnaur I mark down the possible route to Sowda, and a mere inspection will show the very different conditions of this line from that of Major Kennedy, with respect to the crossing of the drainage of the country.

33. It would seem that nearly enough had been said with respect to the route to Candeish *via* Surat and the valley of the Taptee, but there is one more point upon which I must meet Major Kennedy. To quote again the conclusion of para. 31 of his memoir: "By the coast we go level to Surat, and branch off by the Taptee valley, and the slight gradient of the river, without passing any range whatever; nor would the distance by this route exceed that over the Ghats."

34. Major Kennedy evidently here has in view the route first proposed, but now rejected, *via* the Malsej Ghat. But even in this case the assertion in the concluding portion of the paragraph would not be strictly true; for by simple measurement on the map, the route *via* Surat and Taptee would be to that *via* the Malsej Ghat, as 16 to 12 nearly, whilst it is still less favourable compared with the present line *via* the Tull Ghat. The three points, Bombay, Surat and

Sowda, or any other town in Candeish, if connected, would constitute very nearly a right-angled triangle, (*vide* accompanying diagram,)



- A. C. 190 miles } 390 miles route proposed by Major Kennedy ;
 C. B. 200 miles }
 A. B. 278 miles route selected by Railway Company ;

of which the route *via* the Tull Ghat would be the hypotenuse ; one leg of this triangle from Bombay to Surat measures 190 miles ; the other, from Surat to Sowda, without allowing anything for deviations of the railroad, is in a straight course at least 200 miles, making a total, if Major Kennedy's route were followed, of 390 miles. The distance from Bombay to Callian by the line at present in construction is 32 miles ; from Callian by the Tull Ghat to Mumnaur by the line already surveyed, and of which the plans are before Government, is 128 miles ; from Mumnaur on to Sowda, may be put down at 115 miles ; making thus a total of 275 miles only, against 370 miles in the route by Surat and the valley of the Taptee.

35. We will assume that either line is constructed at Major Kennedy's minimum of 5,000 *l.* per mile, not admitting, however, the sufficiency of such a sum ; yet, for the sake of comparison, that amount will do as well as any other. We have, then, the first cost of the one line, 1,950,000 *l.* ; whilst the Tull Ghat route would be only 1,375,000 *l.* But in addition to this, due weight must be given to a further very important point : not only would there be this difference of first cost of construction, but the cost of working and maintaining thenceforward 115 miles of unnecessary railway.

390 miles at 5,000 *l.*
 175 miles at 5,000 *l.*

36. That the traffic would bear this, I think highly problematical, the more so, as in a commercial point of view (I put political questions aside), the line of 190 miles between Bombay and Surat cannot be calculated upon as one that could be worked at a profit. Surat is still a port of considerable importance, and for eight or nine months of the 12, the communication between it and Bombay by boats and steamers is constant and regular ; taking the cost of tonnage between the two ports at 4 *s.* and 8 *s.* per ton for heavy and light goods respectively by the sea route, it is evident that, unless the rates by rail could be reduced to somewhere about a farthing and a halfpenny per ton per mile for these 190 miles, there would be little prospect of any considerable portion of the staple traffic, cotton, being conveyed by its means.

37. I think that I have advanced sufficient to show, that Major Kennedy's proposal for opening the communication between Bombay and Candeish *via* Surat and the valley of the Taptee, is in the first place, under present circumstances of the country, hardly practicable, and that were it otherwise, it could not compete profitably with the route now proposed for adoption by the Great Indian Peninsula Railway Company. On the merits or demerits of this fact I shall not now enter ; it has already been placed before Government in a clear and practicable Report, and the nature of the works required, the probable cost of the undertaking, and all other points of importance, are deduced from close, actual and laborious survey of the country : it is, therefore, deserving of support against any propositions which are not based on equally sure data. And the crowning argument in favour of the Tull Ghat route into Candeish over that by Surat is this, that by it we occupy a line of large present and yearly increasing traffic, the Tull Ghat road, bad as it yet is in many portions, being the great line of communication between Bombay and Central India. By the route of Surat and the valley of the Taptee, we should pass through a line of country on the first 190 miles of which, at present, nothing to be called a traffic exists, that being

all

all sea-borne; whilst, through a large portion of the remainder, we should pass through a country in which, at present, not even a foot-track exists. It is a hazardous experiment, even under far more favourable circumstances than that now before us, to attempt to interfere largely with established commercial routes, and no sound reason exists for attempting to disarrange that already adopted by the traffic of the country.

38. If, in what I have now said, I have succeeded in showing that the route by the Tull Ghat to Candeish is preferable in every respect to that proposed in Major Kennedy's Memoir, but one more point remains for me to enter upon, viz., the method suggested by Major Kennedy for ascending the Ghats.

39. I feel the greater difficulty in this matter because I have to argue seriously against a project which I am confident could never have been for a moment entertained by any person who had, I will not say carefully examined this range of mountains, but merely ridden along their base and looked at them. I shall, however, treat the question as shortly as possible, and for this purpose will take up the case of the ascent of the Bhoire Ghat under the circumstances that will be most favourable to Major Kennedy, viz., to assume the steepest gradient he admits, 1 in 176, requiring a base of 50 miles in length to overcome the ascent, and suppose it for the present, for the sake of argument, a practicable scheme in an engineering point of view.

40. The present line of railway is now in course of completion up to Cullian; we may therefore take this as the starting point. First, then, as to mere mileage.

From Cullian to a point 15 miles south of the Malsej Ghat, the point selected by Major Kennedy for the commencement of the incline, the distance is about

-	-	-	-	-	-	35 miles.
Ghat incline	-	-	-	-	-	50 "
From top of Ghat to Bonah	-	-	-	-	-	40 "

125 "

By the route surveyed and mapped, and which is now before Government, the distance from Cullian to Poonah is - - - - - 81½ "

Difference in favour of Great Indian Peninsula Railway route over that now proposed - - - 43¼ "

Valuing this at Major Kennedy's rate of 5,000*l.* £.
per mile, his line would cost - - - 625,000

Whilst that now before Government would cost - 407,500

Difference in favour of present line - £. 217,500

Although this price of 5,000*l.* per mile is far too low, it serves as well as any other amount for the sake of comparison; for of course the same prices must be applied to both projects. Major Kennedy's rate cannot be assumed for his line, and our higher one, obtained by survey and calculation on the ground, used for the other route.

41. Thus much, then, for the mere first cost of the lines; but what is to be said in favour of that one which so unnecessarily lengthens the distance between two places upwards of 50 per cent.? Or if, to quote Major Kennedy's own words, paragraph 57, "the traffic of India has no broad margin like that of England to cover grave errors," to what are we to look to compensate for the annual maintenance and working of 43½ miles unnecessary line contemplated in laying out that between Cullian and Poonah, with a length of 125 miles, when the same can be accomplished efficiently with 81½ miles of railway? If the traffic of India should prove to be of the character supposed by Major Kennedy, is it likely that it would easily bear an addition of upwards of 50 per cent. to its mileage?

42. But I have now to take up the subject of the feasibility of the scheme proposed by Major Kennedy for the ascent of the Ghat. Major Kennedy commences this part of his case with an estimate of the cost of tunnelling, premising that the Ghats are most favourable for work of this description. Not to take up too much time on this part of the question, I will merely refer to

paras. 11 to 13 of my Report,* No. 126, of the 7th October 1852, and mention that whatever may have been the opinion formed by those engaged in the first examination of the Ghats in 1845-46, actual experience in tunnelling operations on the present line of railway, and a knowledge that the nature of the rocks to be encountered in the Ghats differs in no material degree from that with which we are now engaged, has led us to decide that by every possible means tunnelling operations are to be avoided in India. To say nothing of the expense, there is the element of time, one perhaps of even greater consequence. I need only mention that in our present operations on two comparatively insignificant tunnels the progress in the one, under the most favourable circumstances, has averaged only five yards per month on each face, or ten yards on the two faces, and this working night and day with free labour and skilled European superintendence; in the other tunnel, where greater difficulties have been experienced, so much as 12 weeks were consumed in one instance in completing 15 feet in length. This question of time is, I am confident, quite sufficient to upset any scheme involving the execution of very extensive tunnelling. What then must we conclude with reference to Major Kennedy's plan, which contemplates 50 miles of line on the face of the Ghats, of which, according to his own anticipations, half a mile in every mile would consist of tunnels, or 25 miles length of tunnelling altogether?

43. Of the estimate framed by Major Kennedy of the expense of operations of this nature I shall say little; either some great clerical error has occurred in putting together his memoranda on the subject, or on estimating the expense of tunnelling at 6*d.* per cubic yard, or 17*s.* 6*d.* per yard forward for a tunnel for a single line, he has left out of the calculation the cost of convict labour, the feeding and guarding the convicts, the value of the superintendence afforded him from the public service, and other items, to say nothing of the want of any information regarding the nature of the material in which his operations were carried on: all this, I must be permitted to say, renders his estimate of no practical value. It may be very well in an occasional public work, where all circumstances suit, for Government to employ convict labour upon it; but it must be evident that on any very extensive scale, such as a long line of railway, this could not be done either with safety or profit, and I speak from experience, having had charge for a long time of subsidiary jails employed on public works. To attempt to reject from the calculations of the cost of a work, the expense in maintenance, &c. of the convicts employed, is a fallacy and a species of self-deception. I will conclude this part of the subject, viz., the estimated expense of tunnelling, put down by Major Kennedy at 6*d.* per cubic yard, by merely mentioning that this is as near as possible the cost in Bombay of digging foundations in ordinary soil, whilst the cost of excavating rock in ordinary circumstances varies from 2*s.* 6*d.* to 3*s.* per yard.

44. But I have now to consider the actual nature of the scheme proposed. Major Kennedy writes, "The precipitous face of the Syhodree range will probably be found to average about one per pendicular to three horizontal, with an elevation of 1,500 to 1,800 feet at some of the Ghats above the more level country at its base. Its crest for the most part offering a serrated line with alternate salient and re-entering segments of curves of varying radii and cords, which we may assume to average somewhat less than semicircles of about half a mile radius, and occasionally diversified with spurs of considerable projection. The principle upon which these data should be dealt with, in order to procure at the lowest cost a road fitted for a locomotive, followed by a remunerative load, will be to conform as much as possible to the natural contour line of the hills, where the width can be obtained by simple side-cutting, intersecting where necessary such portion of the projecting segments by cuttings or tunnels, and of the re-entering segments by embankments or viaducts, as shall bring the general line within the limits of well-considered radii of curvature." He then goes on to propose, that for the purpose of ascending the Bhore Ghat for instance, a point for commencing the ascent should be chosen about 15 miles south of the Malsej Ghat, and at the foot of the range, and an incline with a slope of 1 in 176 formed along the face of the mountains, partly by side-cutting

* Copy sent to Government of India with letter dated 15 October 1852, No. 456.

cutting and tunnelling, and partly by the construction of viaducts, until such slope would come out about the summit of the Bhore Ghat.

45. It is a very difficult thing, requiring a peculiar talent, that of scenic description, to bring by simple writing an ordinary landscape clearly before the mind's eye, and not laying claim to such art. I despair in a great measure of enabling a stranger to the Ghats to realise fully the nature of the district; nothing but plans and sections of the most detailed and accurate description would enable me to do this; but I assert, and that without fear of contradiction from any person acquainted with the Ghats, that the project of Major Kennedy is but one step removed from the impossible.

46. His description in the before-quoted para. of what the "Syhadree range will probably be found," I must be permitted to say, affords anything but a correct idea of the nature of that range. The Ghats have been likened to a wall, and not untruly so; broken this wall is by huge chasms, and in places by projecting spurs. Whether the slope, where there is a slope, would be found, as Major Kennedy anticipates, to average about one perpendicular to three horizontal, I cannot say with precision, but throughout the entire length of the Ghats from north to south, there is one feature which he has overlooked, and that is, that there exists a sheer precipice in the strictest sense of the word, varying from 200 feet, to, in some places, perhaps 500 feet perpendicular height. This precipice is not always the very crest of the range, but is found perhaps generally between the middle and the top; it is broken by huge fissures, and in many places runs out apparently only to recommence a short distance further on. During the monsoon, cascades in all directions pour over the face of this bed of rock; a line of road taken up this, after the fashion proposed by Major Kennedy, would, setting aside all other difficulties, come out upon chasms, the passage of which would require viaducts of a description, I may safely say, hitherto unprecedented for height or magnitude.

47. As to the commencement of such a work, I may observe, that to get even a footing for the workmen, it would be necessary throughout considerable lengths of it to sling the men over precipices, there to commence operations in situations where yet the foot of man never trod. I have said before, that the work is but one remove from the impossible, and in these days it is impossible; it is one of those works that might be attempted, and perhaps carried out, by a ruler of irresponsible power and unlimited command of men and money, and when completed it would rank as one of the most, if not the most, stupendous works of the sort; stupendous, not in the same sense as the Britannia Bridge, where it is the grandeur of the conception and the bold application of an entirely new theory of engineering that excites the wonder of the spectator, but only from the consideration of the vast amount of labour and money that must have been expended in its construction.

48. After what I have now said, it would seem superfluous to advance further objections to the project, but there is one which I would yet mention: it is proposed to construct a line of railway, gradually creeping up the face of a precipitous range of hills for a length of 50 miles. The annual fall of rain varies from 180 to 200 inches at Khandalla, and this falls principally in three months of the year. Of the works necessary for the protection of a line crossing at right angles the whole drainage of such a locality, all must at present be surmise. I will, however, mention, that in 1832, 1833 and 1834, I was employed at Khandalla and its vicinity; this was but shortly after the opening of the New Bhore Ghat road, which, only four miles in length, ascends a spur without any very extensive side cutting; nevertheless, whenever the natural soil had been disturbed by side cutting, though all ordinary precautions had been taken, vast masses during the monsoons would frequently slide down on to the road from above, rendering it almost impassable for days, and requiring the constant labour of a body of men to keep it clear. And although, of course, the frequency of such accidents has diminished by time, and when they do occur they are not of the same extent, still even at this date, after the road has now been open for upwards of 22 years, partial slips do take place. The case of a railroad, subject to such accidents for 50 miles of its length, can be better imagined than described.

49. Major Kennedy estimates the cost of this work at 5,000*l.* per mile. I have already shown that one of the principal data upon which he founds this estimate, viz., the cost of tunnelling, is erroneous. I will not, however, undertake to correct his estimate, by stating what I think the work would cost, as I could not presume to attempt such a thing without the most detailed plans and surveys, though, as far as my own credit goes, I feel that I might safely do so; for the sufficiency or otherwise of such estimate would, I am sure, never be practically tested.

50. There is one more observation which I would be permitted to make: it is, I am aware, strictly speaking, no argument, but is still worthy of some consideration on an occasion like the present. The project for ascending the Ghat, laid down by Major Kennedy, contains no new idea; everybody is aware that a better gradient is found by leading a railroad or an ordinary road along the face of a hill, and gradually surmounting it, than by facing the said hill in a more direct manner. I would ask, therefore, is it just to the numerous parties of all descriptions, well acquainted with the ground, who have given their attention to this subject, to say nothing of the talented and experienced civil engineers who have for the last two years been engaged in a laborious instrumental survey of the whole district, to suppose that the very obvious plan proposed by Major Kennedy, if feasible, should have been so utterly lost sight of by all, and remain to be discovered by one at a distance, and who evidently cannot ever have visited the locality?

51. Before closing, I would beg to apologise for the seeming prolixity of this letter, but I have been placed under the serious disadvantage of having to combat propositions which I am bound to say are, in many instances, advanced on no better grounds than the writer's assumptions. Propositions brought forward in this way, can of course be stated with whatever brevity the writer pleases, whereas objections to them necessarily require that the subject be more fully discussed.

52. One more point I would request permission to mention. It has not anything directly to do with the matter in hand, and may possibly appear somewhat personal. Should the Right honourable the Governor in Council deem what I have advanced of sufficient force to allow of his adhering to his former opinion with respect to the project for the extension of the railway beyond Cullian, and see no reason to propose to the Supreme Government and Honourable Court any modifications of it, consequent on the receipt of Major Kennedy's memoir, it may then happen that that memoir may be recorded without being sent for consideration to the Railway Company. In such case I feel it to be almost an injustice to gentlemen with whom I have now been associated for the last three years, that certain passages of the memoir should be placed on the Government records without notice, especially as those gentlemen will not have the opportunity of protesting against the spirit of them. I allude more particularly to paras. 24, 25, and 26 of the memoir. I shall not enter into a discussion as to what parties were most to blame at home, more especially during the period when what has been well designated as the railway mania prevailed. Possibly there was blame attachable to all sides, but there is nothing whatever to show that it all rested with the engineers. I will only ask permission to state, that from the habits of intimacy upon which I have been with the gentlemen now in the employ of the great Indian Peninsula Railway Company, as well as what I know officially from my association with them on matters of duty for the last three years, I do believe that there are no grounds upon which useless extravagance on their part is to be anticipated, but, on the contrary, I have every reason to know that they are, one and all, most anxious to economise, as far as safety and sufficiency of the works will allow.

53. The capital raised for the line from Bombay to Cullian was 500,000*l.*; of this there are now good grounds for anticipating that there will be a clear saving of 100,000*l.* This is no ordinary circumstance, either in railway affairs or large public works in general, and when the work done comes to be compared with the amount expended upon it, the extremely economical views of even Major Kennedy may possibly be satisfied. From the sum of 400,000*l.*, a deduction must first be made of 30,000*l.*, admitted by the Honourable Court, under the head of previous expenses, and applicable to charges incurred on the examination,
&c.,

&c., of the Malsej Ghat scheme, some years ago : that the present scheme has benefited by the examination and surveys then carried on, there can be no doubt, although no part of the said sum of 30,000*l.* was actually expended on the present project.

54. The sum, then, actually expended, it is now pretty clearly seen, will amount to about 370,000*l.*, and we may now inquire what has been done for this money.

55. First, then, including the Mahim branch, the contracts now in hand, two of which are approaching a completion, exhibit a total length of railway of somewhat upwards of 33 miles ; this divided into 370,000 *l.* will give an average rate of about 11,212 *l.* per mile ; but of this 33 miles no less than 20 miles, or nearly two-thirds, is completed as a double line. This 20 miles of double line through the islands of Bombay and Salsette are, from local circumstances, of a much more expensive description than would be the case further inland.

56. There are, first of all, two expensive road bridges, carrying the ordinary road over the rail for the two most frequented thoroughfares of Bombay ; there are other two also, but in situations where, from the line being in a cutting, they are of a less expensive nature. Again, the level crossings and gates rendered necessary by the greater number of public roads intersected by the line are very numerous, and throughout the vicinity of the town the fencing, either walling or palisade fence, is of a much more expensive character than is required elsewhere.

57. Again, although the country is generally favourable throughout, there is an extensive embankment across a deep marsh, a very large viaduct of 22 arches, and one large opening of 84 feet, with box iron girders. This viaduct, crossing a large arm of the sea, has a headway of 30 feet above high-water mark : some distance beyond this there is another viaduct over a salt-water creek, besides two tunnels, which, although of no great length, add considerably to the cost of an otherwise ordinary line. Where the line is laid as a single line, the works, such as bridges, viaducts, tunnels, &c., have all been constructed for a double one.

58. In addition to the above there are, on the islands of Bombay and Salsette alone, consequent on the anticipated requirements of the passenger traffic of a very populous district, no less than five stations, not including the terminal one at Bombay, sufficient for the line when extended to a much greater distance into the interior.

59. There is much here, then, which takes the line out of the category of ordinary lines, but there is this yet further to be considered, that besides the works above alluded to, there has been provided a rolling stock, with all requisites sufficient to work at least 50 miles of railway ; and many preliminary expenses, not to be expected in future, have been included in the amount of 370,000 *l.*

60. The above will, I think, be sufficient to show that economy has not been lost sight of.

61. In conclusion, I think it may be granted that the construction of a line of Railway into Candeish, as proposed by the railway company, *via* the Tull Ghat, is of direct and immediate consequence to Bombay, whatever great political value there may be in any of those suggested by Major Kennedy. One of our richest provinces on this side of India is approached by the most direct route ; it is not sought to direct the traffic of the country, but only to occupy the route it has followed for a long series of years. The country onwards from Candeish appears to offer every facility for the extension of the line to the eastward, so that we may hope to fall in with the Calcutta line in its extension to the north-westward, and thus complete the communication between Bombay and Calcutta by rail ; a result looked forward to, I imagine, with much greater anxiety by the mercantile interest in Bombay than a present communication with Agra.

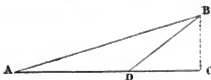
62. If in what I have written I have succeeded in showing that for a communication between Bombay and Candeish the route by the Tull Ghat is far preferable to that proposed by Major Kennedy, *via* Surat and the Taptee, and also that Major Kennedy's plan for ascending the Ghats by an incline along their

face for a length of at least 50 miles is not feasible, I trust Government will feel induced to continue the support already afforded to the designs of the Great Indian Peninsula Railway Company. If delay occurs, and the work is not pushed on beyond Cullian at once, so as to meet the general traffic of the country, the portion now completed, or nearly so, will be next to useless. The delay will intimidate capitalists at home, and, as far as the natives of this country are concerned, must destroy any confidence they might otherwise have had in railways in general, when they see a project so energetically commenced, and carried through to a certain point, suddenly stopped for reasons they can never appreciate. I feel confident that if our railway is stopped pending the consideration of Major Kennedy's extensive projects, the delay which must necessarily ensue will paralyse railway progress for years to come.

I have, &c.
(signed) *J. H. G. Crawford*, Captain,
Superintending Engineer, Railway Department.

P. S.—In para. 11 of the above Report, I have alluded very shortly to the fourth proposition in para. 38 of the memoir, relative to what Major Kennedy terms "impulsive planes." I merely said, "the plan may possibly be a good one," and ventured no further on the discussion, seeing that whatever might be its value in a country of a generally uniform slope, it was quite inapplicable to Western India, where the features of the country would obtrude questions of much too great importance relative to gradients and corresponding works to allow of a line being laid out with anything like an approach to the minute uniformity which Major Kennedy apparently desires.

2. On reading over again, however, note (A.) to para. 52 of Major Kennedy's memoir, where he says, "a principle has occurred to me, as given in Appendix No. 4, by which the engine may be enabled to surmount considerable ascents with the load due to a level road," it has struck me that Major Kennedy may mean that he has discovered a plan by which he can move a weight a certain height without a corresponding exercise of power. The note either means this, or there appears to be a want of that precision with which a mathematical proposition requires to be enunciated.



If A B represents a given gradient, it appears to me that in the end just as much power must be exerted to move a given load, say 100 tons, from one point to the other by any other disposition of the rails, as for instance A D, D B, as if the load had been moved along the uniform slope A B.

3. This is not the place for the discussion of a mechanical problem; I merely mention what I have now said, that I may not seem in para. 11 to concur in any mechanical fallacy.

(signed) *J. H. G. Crawford*,
Superintending Engineer.

31 January 1853.

(True Copy.)

(signed) *H. E. Goldsmid*,
Secretary to Government.

ABSTRACT of Major Kennedy's Memoir.

Home Cons.
22 Dec. 1852.
No. 24.

THE accompanying Memoir by Major Kennedy, on the subject of railways in India, has been forwarded by the Court of Directors for the consideration of the Governor-General of India in Council. The following is an outline of its contents:

Considering that the Government, when it guarantees a return for capital invested in Indian railways, should not only be convinced of the incalculable benefit of railroads in India, or rest satisfied even with the almost certainty of the

the money so invested, affording ultimately a remunerative return, but is bound and entitled to be assured of a direct and immediate equivalent gain to itself from the establishment of railroads, by which, in the event of being called upon to pay the guarantee, it would be enabled to do so without any additional charge upon the revenues; Major Kennedy endeavours to show whence such an equivalent gain may be looked for, and what measures are necessary for securing it.

The increased efficiency of the army, which would result from a well-arranged system of railways, and the corresponding reduction in its cost, would, in Major Kennedy's opinion, of itself repay the outlay of the whole of the payments guaranteed by Government.

"No one will deny," he observes, "that the efficiency of an army is in some inverse ratio to the time required to concentrate such a preponderating force of well-trained troops on any given point of its lines of defence, as shall secure victory over the largest hostile force that can be expected to attack it."

"What the exact ratio of increased efficiency may be as compared with the increased power and rapidity of concentrating troops, and conveying artillery and commissariat supplies to the first place of assembly for a campaign, as well as in the subsequent supply of reinforcements and provisions, it is difficult to express in precise numbers. But it would probably not be straining the argument, to assume that two-thirds of any given army for the protection of British India, would be much more efficient where a field force of 50,000 or 60,000 men, with ample artillery, stores and provisions, could be congregated on any point of its vast lines of defence in 20, 40 or 60 hours, than the whole of such an army would be under the present system, requiring a mean period of three or four months to bring such a force together."

But although one-third of the numerical strength of the army might thus be dispensed with, Major Kennedy does not calculate on a reduction of the military expenditure in the same proportion. Certain charges are such as would not be diminished by the power of rapid movement and concentration, and for such charges he allows one-fourth of the whole. One-third of the remaining three-fourths, i. e. one-fourth of the whole, he assumes as the probable amount of saving that would result from the introduction of railroads, and this amount, therefore, he considers, may be fairly held to be available for investment in railways.

Quoting from the last Parliamentary Returns, Major Kennedy puts down the military expenditure of India as it was in 1848-49, at 9,32,99,356 rupees; and in the annexed Table he shows what might be done with the saving on this amount at different rates of guarantee on capital, and of cost per mile of construction.

Presidency.	Present Cost of Military Establishment, as given in Parliamentary Return for 1848-49.	Annual Saving upon Military Establishment, which would accrue from the Introduction of Railway Intercourse.	Capital which may be raised for Construction of Railways upon Annual Saving in Col. 2.			Number of Miles of Railway which may be constructed by Capital in Col. 4, at per Mile.						Number of Miles which may be constructed by Capital in Col. 5, at £5,000 per Mile.
			5 per Cent. per Annum.	4 per Cent. per Annum.	3 per Cent. per Annum.	£. 5,000	£. 6,000	£. 7,000	£. 8,000	£. 9,000	£. 10,000	
	Col. 1.	Col. 2.	Col. 3.	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10.	Col. 11.	Col. 12.
	£.	£.	£.	£.	£.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Bengal -	4,933,538	1,348,384	24,967,680	31,209,600	41,612,800	6,241	5,210	4,438	3,901	3,467	3,120	8,322
Madras -	2,620,621	655,155	13,103,100	16,378,875	21,838,500	3,275	2,729	2,359	2,047	1,819	1,637	4,367
Bombay -	1,715,775	428,943	9,578,860	10,723,575	14,298,100	2,144	1,787	1,531	1,340	1,191	1,072	2,859
Total, £.	9,329,953	2,332,482	47,649,640	58,312,050	77,749,400	11,660	9,716	8,324	7,288	6,377	5,829	15,549

Major Kennedy is convinced that "5,000 *l.* per mile ought amply to suffice for single tracks;" but, nevertheless, proceeds in his calculations on the supposition the cost will be 10,000 *l.*, and asserts that, even at this rate the mileage would

would be quite sufficient to open the main lines of trunk road throughout the several Presidencies: it would give, he says,

For Bengal	-	-	-	-	-	3,120	miles.
For Madras	-	-	-	-	-	1,637	"
For Bombay	-	-	-	-	-	1,072	"
TOTAL						5,829	"

But in order to secure the utmost advantage from railways, it is necessary that every precaution should be observed for their judicious arrangement and management.

"It is" observes Major Kennedy, "imperative to adopt the most arduous and incessant scrutiny of all projects, as well as supervision in the subsequent execution, to eradicate the grave errors in the former and the extravagance in the latter, which will otherwise assuredly emanate from those trained in the practice in England."

With a view "to direct, concentrate and combine with useful effect the efforts of well-intentioned active minds," Major Kennedy proposes for the adoption of the Government of India the following rules:—

1st. "That all railways constructed in India shall belong to one of two classes; the first or the second class.

2d. "That the regulating gradient of the first class or trunk railway shall not exceed 1 in 2,000: by regulating gradient is meant the gradient which shall regulate the load of the engine.

3d. "That no regulating gradient of any 2d class or branch railway shall exceed 1 in 330.

4th. "That short alternate impulsive plans may be introduced to assist the ascent, not to exceed a length of half a furlong each, and not to be nearer to each other than one and a half furlong.

5th. "That no line shall be undertaken when the estimated cost shall exceed the average rate of 5,000 *l.* per mile of single track; but that this rate of cost is not expected to include the bridging of large rivers, as the Soane, Jumna, &c., exceeding half a mile wide at flood level; such rivers are to be considered as breaks, or temporary termini, where goods and passengers are to be carried across on rafts.

6th. "That no line shall be sanctioned except for a single track of rails, with masonry, cuttings and embankments to correspond. The ground, however, required for a double track to be in all cases secured.

7th. "That no locomotive engine shall be introduced to India for 10 years, except such as the ratio between the length of stroke of piston and the diameter of the driver wheels shall sanction, with reference to the maximum load. Notwithstanding any sacrifice of velocity on the journey, rule No. 11 contains an exemption from this restriction.

8th. "That when piling for foundations be requisite, the foundations are to be laid to suit a double track, although the superstructure is only carried up for a single track.

9th. "That no portion of any line shall be permitted to open for the transport of goods or passengers until the capital account for the construction of such portion shall have been closed.

10th. "That no more than one train daily shall run in each direction upon any line until the traffic shall furnish more goods and passengers than one engine can carry; after which a second may start daily each way, and that when the traffic calls for three trains fully loaded per day, then arrangements shall be made for laying down a second track for rails.

11th. "That, notwithstanding the tenor of rule of No. 6, if on any line it shall appear that the profits exceed a dividend of 6 per cent. per annum, it shall then be permitted, if thought advisable by the directors of the company interested, to introduce engines of higher powers of velocity, with a view of running passenger-trains separate from goods-trains.

12. "That the height above the sea of all obligatory points throughout India, having reference to the construction of works, draining, irrigation, &c., such as the highest points or necks of valleys, the low passes in mountain ranges, be obtained, and recorded with all convenient despatch on the maps now in progress of construction by the Surveyor General's department; and that in addition to this, the height of numerous points of inundation level to be taken upon the

rivers

rivers of India, and recorded upon the maps at intervals of two or three miles, so as to admit of the protraction of proximate sections of the slope of such rivers; and that any striking peculiarity in the lines of rivers, or of the ground between adjacent rivers, be reported upon to the Surveyor-general by his subordinate officers, such reports to be methodically arranged in his office as records."

In addition to the principles laid down for observance in the above rules, Major Kennedy points out some of the great leading features in the geographical formation of the Peninsula of Hindoostan, which should be borne in mind.

These are described as follows: 1st. The Great Western range of hills parallel to the coast, at a medium distance of about 40 miles from it, and running south from the Taptee Valley, south for 700 or 800 miles.

From the western range a formidable spur projects for about 400 miles to the eastward, reaching near to the centre of the Peninsula from a point in the Ghat, a little to the north-east of Bombay.*

"A feature of much general importance in our present consideration is the Great Amerkuntuc table-land; it sheds its waters in every direction.

1st. "To the north-east by the Soane Valley which falls into the Ganges, and passes Calcutta.

2d. "To the south-west by the Nerbudda and Taptee, which fall into the Gulf of Cambay on the Bombay coast; and, 3d, the south-eastward by the Gango, Godavery, Mohanuddy, &c., which flow towards the Madras coast.

"Keeping these great geographical features in mind,—and they cannot be overlooked in any general project without fatal error—they force upon us the knowledge of what the great arteries of commerce must necessarily be, and with those arteries our trunk roads must correspond. We must remember the valleys of the Ganges and Jumna, whose waters flow from the Hymalaya to the south-eastward for about 1,300 miles, passing by Calcutta, and many of the richest districts in India. If we keep these leading features always in mind, and seek to accomplish the object in view without throwing away our great natural advantages, attempting to outrage scientific axioms, or fruitlessly striving to accomplish what is inadvisable, merely to gratify erroneous local influences which are taken up in total ignorance, or carelessness of first principles, there will be no doubt that singularly profitable trunk lines can be selected throughout India, which shall admit of judicious ramifications to any extent that local interests can possibly demand hereafter."

Major Kennedy then goes on to consider in detail of lines of railway, which, in accordance with the principles thus laid down, "would lead to the most perfect and comprehensive system of intercommunication that can at any future time be looked for in India." "It will be observed," he remarks, "that the direction given to all the railways in this project is as much as possible in the course of the valleys, and that as rarely as may be it is proposed to cross any valleys or ranges of hills transversely."

Supposing, in the first place, that capital was procurable on no lower guarantee than 5 per cent., the following railroads might, he supposes, be constructed by means of the saving on military expenditure above noticed; and they should be constructed, Major Kennedy thinks, in the following order:—

- 1st. From Calcutta *viâ* Rajmahal to Agra.
- 2d. From Bombay *viâ* Surat, Baroda, Ahmedabad and Nemuch to Agra.
- 3d. From Surat through Khandeish and Berar *viâ* Rajamundry, Masulapatam, &c. to Madras.
- 4th. From Madras to Trichinopoly, and thence to Pomany, on the Malabar coast.
- 5th. A branch to Bungalore from Madras.
- 6th. A branch from Bombay to Sholapore.
- 7th. An extension of the main line from Baroda to Tattah and Kurrachee.
- 8th. A branch from Masulapatam to Hydrabad.
- 9th. An extension of the main line from Agra *viâ* Delhie to Lahore.
- 10th. An extension of the main line from Tattah *viâ* Hydrabad, along the banks of the Indus, to Mitton.
- 11th. An extension of the main line from Rajmahal to Saibgunge, through Denagpore, and thence a branch to the foot of the Darjeeling Hills.
- 12th. A branch from Kurnal to Simla.

In

* Since writing the above, a principle has occurred to me as given in Appendix, No. 4, by which the engine may be enabled to surmount considerable with the load due to a level road.

In a second fly sketch additional lines are marked, which might be constructed should it be found possible (as Major Kennedy is sanguine that it would) that capital could be raised with a guarantee of only 3 per cent. It seems scarcely worth while, however, at present to pursue further a scheme of which the completion must, under any circumstances, be delayed to so distant a period. It is of more immediate importance to consider the remarks on the future direction of the Bombay line, to which the attention of the Government is especially directed by the Honourable Court in their despatch, forwarding Major Kennedy's Memoir.

The deed of contract between the East India Company and the Great Peninsular Railway Company is "for the construction of an experimental line of railway from Bombay to or near to Callian, with a view to its extension to the Malsej Ghaut." The portion of this road up to Callian has all been given out to contract, and is in progress of construction; but the Government of Bombay concur with the railway engineer, the superintending engineer, and the committee of Directors, in thinking that "the Malsej Ghaut extension ought to be finally abandoned, and the double Ghaut system, consisting of the north-eastern extension by the Thul Ghaut, and the south-eastern by the Bhore Ghaut, should be taken as the basis of operations."

Major Kennedy's remarks proceed on the supposition that the Mulsej Ghaut route had been determined upon; but the principle of his objections extends equally to the lines now advocated by the Bombay authorities. Indeed, the possibility of some other similar route being adopted was evidently contemplated by him, and his views appear not to have been in any way changed by what he calls "the smaller question," as to "whether the Malsej or the Bhore, or any other particular Ghaut, might have been the preferable one, through which to reach the table-land." The following are his observations on the subject:—

"In this view, I apprehend that the project now in progress at Bombay calls for some very important modification of the original design. It is to be hoped, however, that this modification may be effected without the necessity of abandoning for one object or another any of the work done. It was an error to contemplate carrying the Great Northern traffic, including that of Candeish and Berar, over the Syhadree Ghauts. At the same time, the portion of road made from Bombay as far as Tannah, will probably be found suitable, as the commencement of the Great Northern trunk road, whilst from Tannah, on by Callian, &c.; the work done may come into use as a branch towards Sholapore, &c. from the trunk line."

It would appear that the projectors of the works now in progress at Bombay, proposed to cross the Syhadru Range by the Malsej Ghaut, 2,060 feet high. They propose to surmount the precipitous portion of the Ghaut, 1,770 feet high, by a fixed engine incline of about six miles, with a gradient of about 1 in 18, or by an alternative incline of 13 miles long, with a somewhat reduced gradient. They would then proceed through the table-land due east for 20½ miles to Alleh, the maximum incline being so great as 1 in 113. At Alleh they would send off a branch to the south-eastward in the direction of Sholapore; but the principal object appears to be the northern line from Alleh, through Candeish, and crossing the Taptee and Nerbudda rivers; they would take the direction of Agra, after passing by Mow, Indore, &c.; they would also throw off a branch from the Nerbudda, bearing on Allahabad. Here, then, we have gravely proposed a most erroneous project of a grand trunk road, by which the whole northern, north-western and north-eastern traffic is to approach Bombay, the important mercantile capital of Western India. Between Bombay and Agra it appears to be the intention that this great trunk line (second only to that of the Ganges, if even second to it) should pass over no fewer than four unnecessary and fierce ranges of mountain, of which, I imagine, the aggregate amount of rise and fall would not be less than from 8,000 to 9,000 feet, whilst on the natural route by Surat and the valleys of the Enbye and Chumbril there is but one summit to pass, at Neemuch between Bombay and Agra. The height of this summit is 1,356 feet, which, added to the fall from Neemuch to Agra, say 850 feet, would make the total rise and fall by this line only 2,206 feet, whilst the distance would be about 120 miles less than that by the Hilly route through the Ghauts.

"The same reasoning which overthrows this project as a general trunk line between Bombay and Agra, holds equally against that portion of it intended to open an intercourse between Bombay and the districts of Candeish and Berar. On this portion of it the aggregate amount of rise and fall would probably exceed considerably

considerably 4,000 feet, whilst by the coast we go level to Surat, and branch off by the Taptee Valley at the slight gradient of the river, without passing any range whatever, nor would the distance by this route exceed that over the Ghauts."

"The best route harmonizes with every general and local interest of India in their widest extent, whether as regarding the north by the route I propose, with the power of throwing off branches, or as regarding the east by the valleys of Taptee, Nurbudda, Soane, Godavery, Lower Kistna, &c.; or as regarding the west by Guzerat, Kurachee, the Indies, &c."

"Nothing can exceed the eligibility of this mode of opening the communication of all those districts with Bombay; nothing could be more preposterous than to think of carrying the traffic of any of them over the Ghauts."

There is no doubt that the interests of the table-land east and south-east from Bombay call for every exertion to open a passage through the Syhadra range. But it is with this view, and this view only, that the work done to the eastward of Tannah can be made available."

"I shall not here enter into the smaller question of whether the Malsej or the Bhora, or any other particular Ghat, might have been the preferable one through which to reach that table-land."

"But what I most earnestly appeal against is the project which has for its object to approach the district of Candeish or Berar, or any other part of India to the north, the eastward, or the westward of those districts by any line whatever passing over the Ghats. I trust that the East India Directors and the Board of Control will resist every suggestion made to them with this object until they shall have heard from the Governor-general of India upon the subject, and I feel firmly convinced that his Lordship's experience will sustain the view which I take of this most important subject. The nature of the error is precisely similar to, though of much greater magnitude than that which I brought under his consideration in the project of the East Indian Railway Company in Bengal. He did not hesitate in adopting the remedy I recommended in the Bengal case, nor will he now for a moment hesitate in protecting those vast districts which the Bombay project would effect from the unnecessary tax on their transport of Goods that would be the inevitable effect of carrying them over several fierce ranges of hills when a much shorter line can be had, avoiding those hills and combining the broadest interest of Indian traffic generally."

Major Kennedy admits the importance of throwing open communication with the districts of the table-land above the Ghats, and in an Appendix (No. 3.) describes how this might be effected by means of one or more branch roads. The system he advocates is what he designates one of impulsive inclines, and will be found described in the same Appendix.

A detailed description of the two proposed lines of railway *vid* the Bhore and Thul Ghats will be found in paras. 79 to 194 of Mr. Berkeley's report, which is among the papers forwarded by the Bombay Government.

Captain Crawford, the superintending engineer at Bombay, has made two suggestions which that Government have referred for the consideration of the home authorities: one of these is, that in a case such as the proposed inclines at the Ghats "the" principle of the atmospheric "railway reversed might be usefully employed." The other is, that in the event of railways in India proving hereafter a source of large and regular profit, the proprietors should be required to contribute to the general revenues of the country.

Possibly the Governor-general in Council will wish to consult the consulting engineers at the several Presidencies on the subjects discussed in these papers, and especially to afford the railway authorities at Bombay an opportunity of considering Major Kennedy's project and remarks. With this view it might be desirable that these voluminous reports should be printed.

23 April.

(signed) *A. R. Young.*

Since the above was written, the report from Madras, on the line proposed for that Presidency has been received. Major Pears's printed report, and the Minutes of Consultation, which form enclosure No. 1 of the Madras Letter, seem to contain all necessary particulars, and his Lordship in Council may wish to consider this subject in connexion with the above projects.

(signed) *A. R. Young.*

NOTE by the Secretary, dated 3 November 1852.

INDIAN RAILWAYS.

No. 51, of 1852,
dated 22 Sept.
Dated 15 Oct.
1852, No. 450.
Dated 9 Nov. 1852,
No. 66.

THESE papers consist of a despatch from the Honourable Court, sending out a memoir on Indian Railways, by Major Kennedy, a despatch from Bombay, referring for the orders of the Governor-general of India in Council a proposed line of railway from Kullian (near Tannah), in a north-east direction up the Thul Ghat, by Nassick, towards Kandeish; and a despatch from Madras, referring, for the same purpose, a proposed line of railway from Madras up the Palamanair Ghat to Bangalore. Mr. Young's memorandum gives an abstract of these papers.

No. 27, of 1851,
dated 23 July.

No. 51, of 1852,
dated 22 Sept.

No. 13, of 1852,
dated 18 Aug.

2. Until now the Bombay Railroad has been managed by the Bombay Government, in direct communication with the Honourable Court; and the preliminary arrangements respecting a railroad in Madras have been managed by the Madras Government in the same manner. But in their despatch, noted on the margin, the Honourable Court intimated to the Government of Bombay that they would defer coming to a determination on the line to be adopted for the Bombay Railway Extension beyond Kullian, until they should receive the opinion of the Government of India, as well as that of the Government of Bombay, on that subject. And in their present despatch they forward Major Kennedy's memoir, with especial reference to his remarks on that line, which is a question on which, they say, they expect the decision of the Governor-general of India in Council. In their despatch, noted on the margin, the Honourable Court intimate to the Madras Government that they leave the precise route for the Madras Railway to the determination of his Lordship the Governor-general in Council, in communication with that Government.

Major Kennedy's Memoir.

3. The object of Major Kennedy's memoir is to impress upon the authorities in England and India, first, the great importance of the speedy completion of such extensive railways in India as will form a grand connected railway system; second, to show the safety with which the Government may construct, or give the necessary guarantee to private companies for the construction of such a grand connected system; trusting securely to reimbursement if the speculation turns out commercially unprofitable, from the vast saving of military charges which a grand connected system of railways will enable it to effect; third, to enforce the absolute necessity, in this view, of guarding against the "incongruous errors of isolated action," by now taking, as from an elevated central point of view, a survey of the Indian empire, and, before money is spent on local projects, forming a matured general design, and laying down correct principles of action, which in no railway to be made or guaranteed by Government shall ever be departed from in practice; and, fourth, to explain the design generally, and the principles, in detail, which, in his opinion, ought to be determined upon. In his memoir he sets forth at length his objections to the line now proposed at Bombay, for the intention of the Bombay Railway beyond Kullian, and to all the alternative lines that have ever been proposed for that railway, all of which, according to his principles, are so fundamentally objectionable as not to seem to him worthy of detailed examination; and the fact that a proposition to make such lines has been made and approved, he treats as a glaring instance of the terrible errors into which want of system and principle must lead. Major Kennedy also criticises the details of the line now in course of construction from Burdwan to the collieries.

4. The reference of the Bombay and Madras projects to the Governor-general of India in Council, now made by the Honourable Court, seems to afford the Government of India the opportunity, or perhaps it should be said, to impose upon it the necessity of coming to a decision on the important principles involved in Major Kennedy's memoir.

5. On the two first of Major Kennedy's propositions as above abstracted, nothing that could be submitted for the consideration of the members of Government, in this note, would facilitate their decision.

6. On

6. On the third it may be mentioned, that the Honourable Court, in writing lately to the Bombay Government, have repeated the instructions conveyed to the Government of India in their despatch, No. 16 of the 15th of May 1850, in the following words; viz. that the objects of a survey of a proposed line of railway should have reference "to the ulterior destination of such a mode of conveyance as forming a part of a general system, the object of which would be to facilitate communication for political as well as commercial purposes, and to effect more ready intercourse with other Presidencies." The determination lately come to by the Honourable Court to refer the projected lines at all the Presidencies to the "decision" of the Most Noble the Governor-general of India in Council, may seem to be nearly equivalent to the authoritative adoption of the principle of working everywhere on one imperial system, under central control, which Major Kennedy advocates.

No. 4, of 7 Jan.
1852.

7. How very much mistaken those are who think that the magnificent design of giving to India the full benefit of railways is advanced by a hasty adoption of every local project for a few miles of railway which can obtain public support, and by the neglect, in a railway case, of that severe examination which all other projects, involving the expenditure of millions, are admitted to require, before they ought to be irrevocably determined upon, is demonstrated by the case of the Malsey Ghat project at Bombay, which has now happened to come under the eyes of the Government of India. The line up the Malsay Ghat was surveyed for two years, was proposed by the Railway Company, was approved by the local Government, and was so far sanctioned at home as to be made a part of a deed of contract between the East India Company and the Railway Company, under which the additional capital has been subscribed. It would be supposed that a locomotive railway, which has to rise some 2,000 feet in a very few miles, is a work that would not have been blindly embarked in; but the fact is, that it has now been discovered that there was an error of no less than 164 feet of vertical height in the survey on which the project was adopted; that is to say, the height to be surmounted was under-measured by three times the whole height which the railway, 200 miles long, from Calcutta to Rajmahal, will have to rise; that the expense in the one item of tunnelling alone was under-estimated by 384,754*l.*, being at the rate of 2,635*l.* a mile for the whole line of railway; that other items were similarly under-estimated; that one tunnel was required which could not be pierced in less than 17 years, until which time no portion of the extension line beyond Tannah could be made useful, and that the line would be carried through a country in which it is now said there is very little traffic, to terminate, in railway parlance, nowhere.

8. On the fourth of the heads above described a few remarks occur to the Secretary as, perhaps, worthy of some consideration.

9. Major Kennedy's grand principle is to connect the several Presidencies by trunk lines, which shall run in every instance along the great valleys, never crossing a ridge of hills, crossing a valley as seldom as possible, and rising over the summit lines (which, of course, must be surmounted somewhere) at their lowest points. He shows how this can be done. From Bombay he runs a trunk line to Surat, whence proceeds one grand branch through Baroda to Agra, and another up the Taptee and down the Godavery valleys to the Coromandel coast, and thence by Masulipatam to Madras. Thus the line he insists on as the first line to be made from Bombay goes nearly due north to Surat. He allows a second-class line to go easterly up the Ghauts for the local traffic of the high land of the Deccan; but for this, seemingly, he would take the Ilore Ghat to the south-east, and not the Thul Ghat to the north-east, which last is the line recommended at Bombay as the first of the two Ghat lines for adoption. If Major Kennedy's views are sound, the extension from Tannah to Kullian, now in progress, which it is reported cannot become a paying line without much further extension, was overhastily adopted, for it may not be in the best line from Tannah to Surat.

10. Probably, as for grand connecting lines, no one will dispute the excellence in general of Major Kennedy's principle. Apart from the class of arguments which it is more especially in the engineer's province to weigh, the arguments for running in the great valleys are predominant. It may be questioned whether, viewed especially as an imperial object, a line running from one grand point to another,

another, by a great detour alongside of and in competition with a navigable river, such as the Ganges, is preferable to a direct line, which would give a good means of communication to a country now destitute of any such means; but where the river is not navigable, as is the case with all the rivers bearing upon the Bombay system, there can be no question that a general preference is due to a river line, because the valleys of the great rivers constitute very generally the richest and most populous parts of the country, and in them are the grand marts of trade, and most of the great military stations.

11. In discussing the Madras project, reasons will be assigned below for thinking Major Kennedy mistaken in his belief that his grand connecting lines can be carried out at gradients even approaching to the *quasi* level of 1 in 2,000.* It will be well to judge, from what is now before Government, if his first-class lines can be carried out universally on his second-class gradient of 1 in 330.

* 1 in 2,000 is something above $2\frac{1}{2}$ feet of rise in a mile.

12. It will be seen that Major Kennedy lays extreme stress on the importance of having Indian railroads on all but a dead level; by that means, and by that means only, he thinks they can be profitably worked. Now, an extreme case of a very long and, in its first cost, a very expensive line, with a small amount of traffic, workable at a very cheap rate per mile, on every ton of goods carried, can certainly be put, which would be demonstrably less eligible than a shorter and cheaper line, workable at a dearer mileage rate per ton. Therefore there must be some point, in regard to distance and first cost, beyond which it is waste of money to go, in the desire to avoid a severe gradient. Without knowing, for every gradient that occurs, and for all probable amounts of traffic, where this point is, it is plain that no doubtful question as between distance and first cost on the one hand, and mileage working cost per ton on the other hand, can be solved to demonstration; indeed, without this knowledge, all opinion as to what sacrifices in money and distance ought to be made for better gradients is merely fanciful. Now, although Major Kennedy condemns wholesale all that has ever been done or projected regarding railroads in England and India, merely because the severe gradients adopted must reduce the engine load, and increase the mileage cost of traction, he has made no attempt, either in this memoir, or in his previous report therein referred to, to give a general formula for ascertaining the limiting point, or even to fix it in any one particular case, so as to prove that there will be actual loss by disregarding his principle, and to show what that loss will be. The suggestion which this consideration leads to is, that a reasonably trustworthy table, showing what the extra working mileage cost per ton in India will be at each gradient, should be constructed before positively adopting any such universal rule as Major Kennedy proposes.

13. On the proposal to limit the number of trains to one each way daily, it is to be observed, that if this were done upon the Benares line, either it would be necessary to carry goods at a wasteful rate of speed, or the railroad would not supersede the present mail-cart dak, which travels 10 miles an hour in a direct line.

14. Major Kennedy proposes that a most ingenious plan of "impulsive inclines," which he has invented, should be introduced at once universally in India; but as the plan has not yet been tried anywhere, it is impossible to foresee that it will be free from all practical inconvenience. It would be, however, very easy to try it on one mile of some one railway now in course of construction.

Bombay Project.

15. The objections that occur as worthy of consideration in discussing the Thulf Ghat line, now proposed at Bombay, are these:—

16. The line will form no part of any grand connecting line, unless Major Kennedy's principles are found to be altogether unsound.

17. The Ghat inclines seven miles in length, which shows, together with a steep gradient of 1 in 37, sharp reverse or winding curves (the sharpest is of 30 chains radius), must be admitted to be a bold work to begin with. It is a part of the scheme that there shall be a branch to ascend the Bhoze Ghat of about the same height, which shows at present one gradient so steep as 1 in 20, requiring a stationary engine. The report of the Government engineer, who recommends the trial of an atmospheric retardation cylinder, by way of avoiding the danger

of

of the descent, may seem hardly equivalent to a positive professional opinion in favour of the safety of the project as it stands.*

* See para. 27 of
Capt. Crawford's
report of 7 Oct.
1863.

18. The traffic seems to be estimated upon fair grounds, and is taken as affording an income of 1,224 *l.* a mile. This is said to be calculated upon a moderate scale of tolls. This scale appears to be 2 $\frac{1}{2}$ *d.*, or 22 pie a mile per ton generally, and double that upon the Ghat incline upwards. This will not be admitted generally to be a moderate rate. The general opinion of the Madras authorities seems to be, that the rate there should not exceed six or eight pie, and the highest rate proposed there is 12 pie, or one anna. The working expenses at Bombay are taken at 600 *l.* a mile, which, at the estimated first cost of the railway, with the above income, would afford a profit of five per cent.; but the grounds on which the working expenses are assumed at 600 *l.* a mile are not stated; no details are given. No precedent is known from which to estimate the working expenses of such a precipitous and long incline as is projected at the Thull Ghat; and as to the first cost, all who have any experience in great public works, of an entirely novel character, in India, know that the original estimates of costs are always, from one cause or another, in the end, largely exceeded. It seems to the Secretary, therefore, that it cannot be securely anticipated from the present papers that the line will pay, unless a very large new traffic shall be created by it; and there would be a better chance for that, if the line were much longer than the present capital will make it. It does not appear what equivalent the Government will have in the possession of a detached line of railway from the sea coast at Bombay to some spot of no importance above the Ghats, where it stops short, for any deficit in the profit which they will have to make good. For the mere purpose of bringing cotton to the sea coast, it would seem, that lines running into the interior from Surat and Branch, should be the most likely and cheapest means.

19. To Major Kennedy's low country line, the only apparent objection is, that such a portion of it as the present capital will make, which would barely reach Surat, probably would not pay; for from Surat, and all intermediate places, there would be the sea traffic to compete with, except during the south-west monsoon; but if Indian railways were carried on in the spirited manner, and upon the grand principles, Major Kennedy recommends, and the Bombay Railway were carried on at once beyond Surat, either (1) up the Taptee to the Coromandel coast, or (2) up the Nerbudda to the Ganges, or (3) by Baroda to Agra, then it would have its fair chance of paying on the whole; and even if it did not pay, Government, in the possession of such a grand connecting line, would have a full political equivalent for the deficit which, under its guarantee, it would have to make good to the shareholders.

20. The Bombay Government promises to send, as soon as they are prepared, copies of a great many maps and plans, as noted in the margin,† connected with the second lines of railway that have been considered at Bombay. These maps and plans have not yet been received. But no survey of the most cursory sort has been made of any one of Major Kennedy's three grand connecting lines above-mentioned, nor has any survey of the most cursory sort been yet made in extension of the Thull Ghat and Bore Ghat lines, to show that these lines are capable of becoming good connecting lines between Bombay and the West Coast. It is for consideration whether it would be wise to determine finally in favour of any decisive line whatever, until Government is in a position to say that such line is preferable to every other, when viewed as the first stage of a grand connecting line to be completed between Bombay and one of the other Presidencies.

Madras.

† No. 2, a map of the Poona Collectorate. No. 3, a map of the Ahmednugger Collectorate. No. 4, a map of Shalapur Collectorate, with the various extension lines drawn upon them. No. 5, a general map of the country, showing all the lines that have been laid out. No. 6, an enlarged section of the Mosji Ghat Deviation Line of 1847. No. 7, a section of the Extension Line from Callian to the top of the Thull Ghat, at Iyatpooia. No. 8, an enlarged plan and section of the Thull Ghat Incline. No. 9, a section from Iyatpooia, via Nussick and Munnar. A plan from Nussick to Munnar. No. 10, a plan and section from Callian to the top of the Bhore Ghat, at Toongalee. No. 11, an enlarged plan and section of the Bhore Ghat Incline. No. 12, a plan and section of the line from Toongalee to Poona.

Madras.

21. The Madras Government refer several reports of Major Pears, their Railway Commissioner, with their own recommendation, as to the lines to be eventually adopted, and the one line to be first commenced upon.

22. The general formation of the peninsula between Cape Comorin and the Vindya Range, which is very simple, is well known. It consists of a triangular ridge of mountains, namely, the Western Ghats on the south-west, having a narrow belt of low rich land (Malabar, Canara, and the Conkans) between it and the sea; the Eastern Ghats, on the south east, having a wide belt of low land, in which rocks and hills are rather thickly scattered, the Northern Sirkars, the Canatu, and southern districts between it and the sea, and the Vindyah Range on the north-west, having beyond it the plains and valleys of Hindoostan. Between these is the undulating, rocky, table land of our own Deccan Provinces of Nagpore and Hyderabad; of our own ceded districts, Bellary, &c., and of Mysore. This mountainous triangle is cut through, near its southern apex, by the very remarkable gap in the Western Ghats at Palghatcherry, south of which the Eastern Ghats do not extend, and where they round in and join the Western Ridge. This gap of low country gives an open passage between the eastern and western coast lands; and the richest districts of Madras are in it, or in its parallel. Excepting at the northern verge of the table land, the drainage of the whole of this vast rocky triangle is from the ridge of the high Western Ghats; in view of the Indian Ocean, right through the table land and Eastern Ghats into the Bay of Bengal. But on its northern verge the summit level of the plateau is in the middle of the peninsula, whence the water runs in the Nerbuddah and Taptee to the Indian Ocean; in the Soane, to the valley of the Ganges; and in the Godavery, to the Bay of Bengal.

23. It is plain that to connect, by railway, the western and eastern coasts, one of three systems only must be adopted; either, first, to drive the line up the steep ascent of the ridges of both Ghats, more than 2,000 feet, and down again; or, secondly, to ascend by the long and easy gradients, offered on the one side by the Nerbudda or Taptee valleys, in the northern part of the table land, and on the other side by the valley of the Godavery, and one of its northern feeders; or, thirdly, to turn the whole triangle, by running the line immediately through the great gap at Palghatcherry, and eventually continuing it to Bombay.

24. The second method is the one recommended by Major Kennedy for immediate adoption; whereby the two coasts and the two Presidencies of Madras and Bombay will be connected, immediately towards the north, by a line ascending much, but very gradually. Major Kennedy's line goes up the Taptee, and down one of the northern feeders of the Godavery, and the lower part of the Godavery. Mr. Turnbull has suggested, as worthy of survey, a line up the Nerbudda, and down the Godavery, with another line from the summit level down the Soane. Either way the great table land is pierced through, and connected with both coasts; and the Bombay and Madras Presidencies are connected towards their northern parts by a good line of railway. By Mr. Turnbull's project, if feasible, the great table land would be also connected with the centre of the Bengal Provinces. Major Kennedy proposes to connect the two coasts by a line running from Madras through the gap in the Ghats, described as the third of the above three possible methods; and eventually he projects the extension of that line up the west coast to Bombay. By Major Kennedy's scheme, Bombay and Agra would be connected by a separate line running through Baroda. All these lines would be lines of Major Kennedy's first class; that is to say, of low gradients.

25. It is probable, or rather it is now certain, that Major Kennedy is very much too sanguine in thinking that these grand connecting lines are possible, with gradients never exceeding 1 in 2,000, or even anything like that *quasi* level. The first 48 miles of the trunk railroad in the Carnatic, now proposed, which does not go half way from the coast to the foot of the Ghats, has a maximum gradient of 1 in 309, and if rose unbroken at one angle all the way, its gradient could be no less than about 1 in 700. The ruling gradient ordered upon

upon Major Kennedy's own line from Burdwan to Rajmahal, through the nearly dead flat of Bengal, is 1 in 1,000.*

That gradient is greatly exceeded on the line from Burdwan to the collieries, in which long gradients of 1 in 823, 1 in 625, 1 in 500, and even in 222 are to be found. This, however is certain, that so much of Major Kennedy's line as comes now into question, namely, the low country line, through the gap in the Ghauts at Pailghatcherry is practicable at what are generally considered favourable gradients; whilst the competing line projected by the Madras Government from Madras in a due westerly direction, up the Eastern Ghauts, and through the Mysore country to Bellary, is now seen to be impossible at any but what are generally considered the very extreme of bad gradients.

26. It is true, nevertheless, that Major Kennedy also proposes a line due westerly from Madras to Bangalore, which is the very line now proposed by the Madras Government to be commenced upon. But Major Kennedy proposes this as an isolated line, and as it ascends the Ghauts, he permits it to be one of the second class of lines. Even his second class of lines, however, allows of no gradient above 1 in 330, which is better than the Madras engineer obtains in the country altogether, below the Ghauts. Major Kennedy, no doubt, never saw either the Ghauts to be ascended, or the undulating country above and below them. Major Pears' report will probably put to flight all idea of lines of railway running up the Ghauts at inclines of 1 in 330. But the comparative difference between Major Pears' real low country and Ghaut lines is much more than that between Major Kennedy's imaginary low country and Ghaut lines, the gradient up the Ghaut being hoped by the Madras engineer to be 1 in 37. Therefore all Major Kennedy's general arguments apply with their full force, whatever that is, against the present project of the Madras Government. For his argument put generally is, that the grand connecting or imperial lines should be the first made, and that no line with comparatively bad gradients should be part of any grand connecting line.

27. The Madras scheme is to have two grand lines, one up the Ghauts to Bangalore and thence to Bellary, and beyond it through the table land, by which line it is proposed by them to connect Madras and Bombay; the other through the Carnatic, in a south-west direction, hugging closely the foot of the Eastern Ghauts, and eventually to be continued so as to pass through the gap in the Western Ghauts, and to connect the eastern and western coasts. This last line in its final direction, coincides with Major Kennedy's grand connecting line, but it adopts at its commencement the Bangalore line for 48 miles, as far as a place called Menil, whence it branches off to the south-west. There does not, from the papers, appear to be any object in this beyond the evident object of making one rail do for both lines, for 48 miles. But as it is said of this trunk portion that it will very soon require to be laid as a double line,† and as it prolongs the south-east line of traffic, unless it has other advantages, which however are not noticed, its adoption, in preference to Major Kennedy's first-class line, may be open, perhaps, to question. Major Kennedy's first-class line starts as a separate line from Madras in a much more southerly direction, and runs to Trincomopoly at the apex of the Delta of the Cooueroon (Cauvery), the most fertile district under the Presidency, whence it turns westerly, and runs straight west through the gap to the western coast at Poniang. But it occurs to the secretary as an objection to terminating this important line even for the present at this obscure spot, that the grand military and political advantages of the line will not be obtained unless it runs to the northward, up the Malabar coast, and passing Calicut and Tellicherry, reaches at least the great military station and commercial town of Cannanore, even if it does not proceed to the great commercial port of Mangalore. Half their troubles in Madras are in Canara.

28. It will be seen, that whilst Major Kennedy's line takes a long detour to the south-east of the direct course, by Salem and Coimbatour to the west coast, the Madras line by Vaniobaddy, at the foot of the Ghauts, takes a detour on the

* The fall of the great highland rivers of Central India must be much more than that of the lowland portion of the Ganges.

† The rails are a large proportion of the whole estimated expense at Madras.

the opposite side of the direct course, whether starting from Madras or from Menil. There are doubtless local circumstances, on account of which the longer line along the foot of the Ghauts is preferred, but what these circumstances are is not mentioned.

29. A line apparently very good, judging only by the map, is what may be called the direct line, starting from Madras and running near Congeveram, Arace, and Salem to Coimbatour, and thence rounding through the gap up Malabar, Aull, Canara to Cannanore. This would be the shortest line possible, and it only differs from the present Madras proposal in the portion between Madras and Salem. It would be satisfactory to know what are the advantages of the proposed line by Vanimbaddy, hugging the Ghauts, over this or some other more direct line; for the distance in a straight line from Salem to Madras can be little less than that in the proposed line from Salem to Menil only.

30. Thus there are three directions to be considered, which the grand line from coast to coast may take :

1st. Major Kennedy's, which makes a long detour to the south-east to pass Trichinopoly, and which would have to cross the Coleroon and several of its feeders.

2d. The direction now proposed at Madras by Menil, Vanimbaddy and the foot of the Ghauts, which makes a long detour to the north-east, for what object is not stated, and which it is admitted goes (some 12 miles apparently) away from the existing main line of traffic, which is through Wallajahmugger.

3d. The direct line from Madras to Salem and Coimbatour, and so to the western coast, which is the line that a mere inspector of the map would first turn his attention to, and ask to know about. There is nothing in the papers sent up from Madras to enable the Governor-general in Council to determine between these lines, nor to show the grounds which induced the Madras Government to give the preference to their proposed (No. 2) direction over all other directions.

31. The Madras Government recommend that the line due west to Bangalore be first made. They think that the low country line to the south-west would be most remunerative to the shareholders, at least at first; but they think the other line entitled to precedence, as being one of more political and general importance.

32. There is a general consideration in favour of beginning with the line most certainly and immediately remunerative, which the Madras Government has not discussed, namely, that as the capital for railroads is to be subscribed by private persons, it is a public object not to discourage subscriptions. If the line commenced with pays well, there will be plenty of money for the second line, but otherwise a second line may never be commenced at all.

33. There are some considerations regarding the proposed line due west of Madras to Bangalore which the Secretary ventures, with great respect, to submit, as he happens to know that country well. Major Pears' excellent reports will probably be accepted as proof that of the ghauts available for quite a direct line to Bangalore, the ghaut of Palamanire (up which there is now a good carriage road), which is the one he has selected, is the best; but it involves a gradient of extreme severity, 1 in 37, according to present expectations. The actual survey, plan, and estimates of no part of the line west of Menil, being three-fourths of the distance to Bangalore, and containing the whole of the difficulties, have yet been received; those of the portion to Palmanaire, containing the pass to the Mysore table land, are promised very soon; but the Government of India is asked finally to determine the question without them. The ghaut may, perhaps, be found not quite the only expensive portion. It is suspected that Mysore may be found rather an expensive country to drive a railroad through; it is a rocky country, continuously, highly and confusedly undulating, much intersected with ravines. The only part of the line, that of 48 miles to Menil, yet estimated for, is estimated at a very cheap rate, materially less than 40,000 rupees a mile. There is nothing to show what the Madras Government expect to be the rate of cost for the other three-fourths of the way; yet this is a material consideration, especially in a line expected to be remunerative only in the second degree. Mr.

Turball,

Turnbull, the engineer of the East Indian Railway Company, estimates the line from Burdwan to Rajmahal, at three times the sum above stated;* and taking the Palamanair Ghaut as equivalent only to the passage of the Adjai and the Mor, they will do well at Madras it, in fact, they do the remaining 141 miles to Bangalore at the same rate as that of the Rajmahal line, maintaining, exclusively of the ghat, good gradients.

34. It is for consideration whether, in the absence of plans and estimates, any course should be finally determined upon which binds to the adoption of the direct west line to Bangalore, and whether the approval of a trunk line to Menil would not be tantamount to such adoption, inasmuch as it may be assumed, in the absence of all reasons assigned to the contrary, that the grand low country connecting line would not be taken 48 miles due west to Menil, except in order to make use of so much of the Bangalore line.

35. Further, a line running from Madras to Bangalore, and not going west of the meridian of that place, can be regarded only as a military and political line. Now, Bangalore is the highest place of the Mysore table land, uninhabited rocks excepted, and, being 3,000 feet above the sea, it is fully 1,000 feet above the mass of the province, which may be taken as being 2,000 feet above the sea. Palamanair is 2,100 above the sea, and it would seem a preposterous project to take a railroad, having commercial objects, between Palamanair and Bellary 80 miles round by Bangalore, which is at right angles to the line forward, involving a rise and a subsequent fall of nearly 1,000 feet. Accordingly it will be perceived Major Pears proposes a distinct line from near Palamanair to Bellary, which shows plainly that nearly 80 miles, or two-fifths of the line as now projected, is for no other object than to get to the great military station of Bangalore. If there is any foundation at all in Major Kennedy's argument, there must be something gravely objectionable in this project.

36. It will be seen that Major Pears anticipates confidently the possibility of running a railroad from Bangalore in a south south-east direction down the Royacotta Pass, or down his newly-discovered pass near Vaniembaddy, to join the low country railroad, and that he has satisfied himself that in that direction ghats at least as good as that of Palamanair exist. Would not a line running from Bangalore southerly, to join the low country railway, be even a better military line than that to Madras directly? It would be much shorter, and it would run directly towards the body of the Madras country, meeting in the middle a railway connecting the eastern and western coasts, Madras and Mangalore.

37. Accordingly it will be seen that it is a line proposed by Major Pears to be eventually made: but if it is to be made at all, and if, when made, it will be preferable to the east and west line now proposed, and in fact will supersede it, at least for all political objects, why should it not be made now, whereby all necessity of ever making the proposed line of double its length may very probably be done away with altogether.

38. It would be very easy to connect the foot of the Neelgherry Hills by a short line with the low country railroad near Coimbatore. So happily placed are the Madras Hills and healthy table lands, that with any reasonably good railroad system, it is hard to see why a single European soldier in the Madras Presidency out of Fort St. George itself should be cantoned out of them.

39. It is respectfully submitted whether all the above considerations do not lead to the decision, that the line first to be made is one or other of the three low country lines, from coast to coast, above described. The half million now engaged for will not be found to go too far, even if restricted to this one railroad.

40. And it is respectfully submitted whether, if this plan be adopted, the railroad should not be made at once, as fast as possible all the way from Madras to the

* £. 12,000 a mile; but Major Baker estimates it at much less. From Houlal to Pundooab the contract is 53,706 rupees a mile; from Pundooab to Rancegunze 30,179 rupees, exclusive of the permanent way, which may be taken at 25,000 rupees a mile. Stations, which may be taken at 4,000 rupees a mile; and fencing, which may be taken at 4,000 rupees. Thus, the cost to Pundooab will be about 81,000 rupees a mile; and from thence to Rancegunze about 64,000 rupees a mile. To this must be added for rolling stock, to begin with, say 3,000 rupees a mile.

the west coast, because Government will have but a small political equivalent for its financial guarantee until that is done.

3 November 1852.

(signed) *J. P. Grant,*
Secretary to the Government of India.

MEMORANDUM by the Consulting Engineer to Government of India in the Railway Department.

THE papers named in the margin* have been communicated for my perusal and comment by the Secretary to the Government of India in the Home Department. They contain matter for much interesting discussion; but in the following observations, I have deemed it proper to confine myself as much as possible to practical questions bearing on the present position of railway enterprise in India.

2. The objects contemplated by Major Kennedy in his memoir are—

1st. To prove that it is alike the duty and the interest of the Government to bestow upon India a perfect system of railway communication.

2d. To define the essential principles of such a system, and to embody them in a series of obligatory rules.

3. I admit the first proposition to its full extent, and am convinced that the more rapidly and energetically this duty is discharged, the more surely and effectually will the interests of the empire be served.

4. I cannot entirely accept Major Kennedy's calculation that the saving on military establishments would alone furnish funds for the extensive system of railway communication which he considers due to the country. For resistance to foreign aggression, or for any other object external to our recognised frontier, the power of concentrating troops by railway would virtually compensate for numerical strength of the army, in a ratio, perhaps, as high as that assumed by Major Kennedy; but I have no reason to believe that the internal condition of the country is, or would be, such as would justify a large reduction, considering that the railways would be in the hands of the people, and would continue efficient only by their suzerainty. Without, however, reducing it to a pecuniary standard, it is easy to understand the magnitude of the indirect advantage which the Government of such vast territories will derive from the railway system, in the enhanced efficiency of their military and civil establishments. There is no necessity to strain this or any other argument, in order to justify a liberal encouragement of railway enterprise. There is no reason to doubt that by means of well-selected and economically constructed lines, the blessings of railway communication may be extended throughout the land, at a price within reach of the great mass of the people, with a sufficient margin of profit to the shareholders, and with eventual immunity to the Government who guarantee the dividends.

5. The guiding principle of Major Kennedy's proposed "Rules" is the necessity of reducing to a minimum the cost of railway service, and as a necessary condition, the construction of such lines only as will admit of economical working. There is some room for diversity of opinion as to the means by which this desirable object is to be attained.

6. Major Kennedy's 1st, 2d, and 3d Rules, limiting the gradients in his first or second-class railways to 1 in 2,000 and 1 in 330 respectively, are probably those which will be least palatable, especially at Madras and Bombay.

7. The perfection of gradients is but one element, however important, in the calculation of the cost and value of railway service, the others being generally the interest or capital, the tariff of fares, the amount and nature of traffic, and the ratio of cost of locomotive power to the other items of annual charge. These conditions will constantly vary, and many of them are not susceptible of accurate
previous

* Memoir by Major J. P. Kennedy, on the subject of Railways in India.

M.S. papers, detailing projects for railways at Bombay.

Printed papers, chiefly by Major Pears, c. n., connected with railway project at Madras.

previous estimate; in each case the projector solves the problem his own way, and the results are as discordant as under such circumstances might be expected; they have, however, certain fixed relations to each other, and these will indicate the circumstances under which the "perfection of gradients" will attain the most prominent importance; viz.

1st. A very low tariff of fares, and consequent necessity for a minimum rate of working charges.

2d. The cost of locomotive power (being the item most affected by gradients) bearing a high ratio to the other items of working charges.

3d. The greater part of the calculated traffic being in goods, and therefore admitting of more economy of locomotive power than would be possible in the conveyance of passengers.

8. If, as I believe*, these are precisely the conditions under which Indian railways are expected to work, it follows that the quality of gradients demands more attention from the Government of India than would be required in England, and still more than has usually been bestowed upon it in that country.

9. Agreeing so far with the spirit of Major Kennedy's "Rule," I cannot recommend the Government of India to adopt the strict limitation which he has proposed, and which would require considerable relaxation even on the favourable levels of the Gangetic Valley. If it be desirable to fix a maximum ruling gradient for trunk lines, I would recommend that if 1 in 1,000 be more generally attainable, and less likely to call for frequent exceptions; but if Government should object to fetter itself by the adoption of any absolute rule, it would still be very necessary to fix and make known the principles on which railway projects are to be framed, and the standard by which Government will judge them.

10. I would ask permission to defer my remarks on the 4th Rule until I have leisure to examine Appendix No. 4, which I have just received.

11. The 5th Rule appears liable in some measure to the objection I have urged against the second. I believe that a single line, not involving expensive river crossings, or other special heavy works, ought to be constructed for 5,000 *l.* per mile; but justifiable exceptions will occasionally arise, and should not be entirely precluded; nor can I advise the unreserved adoption of the rule by which the bridging of large rivers is to be indefinitely postponed. In this respect also each case must be judged on its own merits. The annual direct and indirect cost of the temporary arrangements for crossing the river must be weighed against the interest of capital required for the construction of the bridge, and the period of time by which the completion of the line would be retarded. What is called "the convenience of the public," should not, in my opinion, materially affect the question. As regards the transit of goods, the delay of a few hours would be of little consequence, and it would not be justifiable to burden the capital account with a heavy expense, merely to gratify the impatience of travellers who would demur to paying a commensurate fare.

12. The 6th, 8th, 9th, and 12th Rules have my entire concurrence.

13. The 7th, 10th, and 11th Rules have reference to the conveyance of goods and passengers, together, and not by separate trains. Such a plan, would, in my opinion, be advisable in the infancy of the undertaking and until the working expenses shall be covered by the returns; it has, however, been frustrated, by anticipation, for Bengal. The locomotive engines now under construction for the East Indian Railway, notwithstanding the injunctions of the Government of India, based on Major Kennedy's and my own recommendation, are of two classes, five being intended for goods traffic, and five for the conveyance of passengers.

14. I proceed

* On these grounds, viz.—1st. It is almost self-evident that a low tariff of fares is alone consistent with the low price of human and animal labour in India. 2d. The cost of locomotive power will bear a higher ratio than in England to the total working charges; because, the locomotives, the drivers for some time, and in Bengal much even of the fuel, will be imported, and therefore dearer. The salaries of all subordinate establishments (who would be natives) and the maintenance of permanent way, will be cheaper, and there will be no rates or taxes. 3d. The reliance on goods traffic as the principle source of revenue appears to be general. I believe that passenger traffic will be very large, but chiefly, perhaps, in the lowest and cheapest class, which would be worked with the goods trains.

14. I proceed with great diffidence to offer a few remarks on the comprehensive scheme of railways for India, proposed by Major Kennedy. Being ignorant alike of the productive resources and of the topographical features of many important districts, I am chiefly dependent on the information supplied by maps.

15. Major Kennedy's project follows naturally, from his "Rules," the lines which stand highest in his estimation being those which promise the most favourable gradient. Most of his first-class lines, and those especially which reach the interior of the country by a gradual ascent of the principal valleys, appear to deserve the first consideration. They would bring into communication with the coast and with each other the districts which are presumably the most fertile and populous, and that too by lines which promise the greatest facilities for economical construction and working.

16. The coast lines hold out the prospect of fewer advantages. They must necessarily cross many rivers at the most unfavourable points in or near their deltas; while throughout their length they have to compete with the best and cheapest description of water carriage.

17. However distant may be the complete execution of a scheme so comprehensive as is here proposed, there can be no doubt of the propriety of determining, as soon as sound data may be attainable, precisely what that scheme is to be, and of encouraging no railway enterprise which would not form an essential part of it. I would respectfully urge the adoption of early and energetic measures for recommitting and levelling such of the principal lines as have not yet been examined; but as this must occupy some time, and as the machinery is already organized for the construction of one line in each Presidency, it is of primary importance at the present time to decide on the lines to be first adopted.

18. Happily, as regards Bengal, there is little room for hesitation in the choice of a first line. That from Calcutta, through the Gangetic valley by Agra and Delhi, to the Sutlej, combines with a singularly favourable profile the highest degree of political and commercial importance, and a fair basis for extension to the other Presidencies.

19. The numerous rivers and inundations which it must encounter will indeed entail considerable expense, but to these it is indebted for the fertility of soil, the density of population, and the rich abundance of agricultural produce, which cannot fail of rendering it the most important and remunerating line in India.

20. I earnestly hope that the simultaneous construction of this line may be sanctioned at once, and that authority may be given to complete the preliminary survey, which already extends to Allahabad, and may without difficulty be pushed on to the Sutlej during the ensuing cold season. Some of the works involved (including the collection of materials) will probably occupy four or five years, the rest might be completed in two working seasons; but I will reserve the further discussion of this provincial portion of the imperial project for my report on the survey operations now in progress.

21. Without entering into the details of the Bombay project, a task for which I am disqualified, by the want of local knowledge, and in the absence of maps and drawings, I would still offer a reluctant though decided opinion against either of the lines so fully described by Mr. Berkeley. The least objectionable of the three lines discussed, that passing north-east by the Thull Ghant, is not such as I could recommend for adoption by the Government of India as part of a general plan. The steepness of the gradients and sharpness of the curves approach the extremest limit of recorded practice, and in their combination would, in my opinion, be condemnatory of the project (as one which under the circumstances of this country could not be worked at a profit), even were the traffic calculated upon not being accessible by another and less difficult route. But I find, from paras. 220 to 224 of Mr. Berkeley's report, that the principal feeders of his north-east line would be those districts of Kandeish and Berar which are watered by the Taptee and its affluents; and Captain Crawford states (para. 13) that "the principal portion of the traffic" (on the proposed north-east line) "appears to come from districts beyond Munmaree." These districts, however,
would

would be tapped by Major Kennedy's No. 3 line, on which the distance would be very slightly increased, and the engineering difficulties being incomparably less. If it be considered by the Bombay Government, in concurrence with the engineers, that the traffic of these districts would justify the construction of a railway burdened with such complicated imperfections as that proposed, still more encouraging would be the prospect of a line free from these objections, and capable of being economically worked.

22. I would therefore recommend, as the first for careful examination and eventual construction at Bombay, a portion of Major Kennedy's No. 2 line to Surat, and of his No. 3 line, at least as far as Oomrawuttee, with a view to its eventual extension, by the Godavery to Madras, and by the Soane to Patna, Calcutta, and Agra. By this plan, the provincial objects of the Thull Ghaut line would be secured, while a railway communication would be established and an acceleration of mails attained between all the seats of government.

23. The extension of Major Kennedy's No. 2 line through Baroda, Ahmedabad, and Neenuch, to Agra, would be, politically, more important than the Tapti extension, and, when completed, would share the traffic of the Punjab and North-west Provinces. Intermediately, however, it would chiefly benefit independent states, and would be interrupted near its outset by two important, and, I suppose, unbridged rivers. Besides these considerations, it might seem unjust to the Bombay Presidency not to allow some weight to the local and provincial advantages which the Tapti line appears to possess over that of the Mohye.

24. The geographical features of the Madras Presidency would appear to limit its lines of easy gradients, in a great measure, to the coast, under the incidental disadvantages already adverted to; and accordingly, under Major Kennedy's plan, the high table lands would be the last to enjoy the benefits of railway communication.

25. It is evident that the lines advocated by Major Pears and the Madras Government, however advantageous to local interest, would not materially promote a general scheme of intercommunication (unless the Bombay lines were permitted to ascend the ghauts); and it appears to me *prima facie*, that the general object would be best secured by a northerly line from Madras to the head of the Kistna's delta, and thence up the valley of the Godavery, to meet the Bombay line already described, para. 22.

26. A line by Arcot and Salem to Coimbatore and the Western Coast would be a sort of compromise between Major Kennedy's view and those of Major Pears. There is a strong presumption that it would be a valuable commercial line; but it would not possess first-class gradients, nor would it apparently further the connexion of Madras with the other Presidencies. It would, in my opinion, be as much a provincial measure as the proposed line to Bangalore and Bellary.

27. It is my opinion, which, however, I submit with the greatest diffidence, that the northern line claims the first attention, and should that be found liable to insuperable objections, that the South-western line would be, on the whole, preferable to the ascent of the ghauts.

28. Some of the Appendices to Major Kennedy's Report have not yet reached me, and others were received late. Having been unable to examine them properly, I would beg to defer my remarks to a future occasion.

(signed) W. E. Baker, Major,
Consulting Engineer, Government of India.

Calcutta, 1 February 1853.

MINUTE by the Most Noble the Governor-general; dated the 20th April 1853.

RAILWAYS IN INDIA.

THE Honourable Court of Directors has recently made a series of references to the Government of India regarding proposals for the construction of various railways in different parts of India.

They comprise a memorandum by Major Kennedy, lately the consulting engineer of this Government, specially directed to a consideration of the lines already proposed at Bombay, but entering largely also into the question of railways for India generally. A subsequent despatch calls for the opinion of the Government upon a specific proposal for constructing a line from Bombay to Agra, *via* Baroda.

The views of the Governor-general in Council are also required relative to the extension of the railway from Calcutta to the North-west frontier, the proper portions to be constructed, and the most eligible mode of carrying them on.

The opinion of the Government of India has in like manner been called for regarding the lines of railway that have been suggested for the Presidency of Madras.

Lastly, a proposal for the formation of a railway from Calcutta to Diamond Harbour has been transmitted for the consideration of the Governor-general in Council.

Upon these the Honourable Court has required opinions with the least practicable delay.

2. The references embrace a variety of questions, whose magnitude and importance can hardly be overstated. The consideration of them involved the necessity of previous reference to the other Presidencies, with whose local projects the Supreme Government had no acquaintance. (It demanded the most anxious and careful deliberation, and a closeness of inquiry which was hardly compatible either with the necessity for early reply, or with the due consideration of other questions occurring in the daily course of events, and imperatively demanding immediate decision.)

The consulting engineer, who was absent examining the extension of the Bengal Railway, was immediately recalled to the Presidency. The consulting engineer at Madras was requested to repair to Calcutta. Distance did not admit of my requesting the presence of the engineer from Bombay; but full reference was made upon the several matters on which it was necessary that the views entertained in that Presidency should be known.

I have had the advantage of conferring personally with Major Baker and Major Pears; and the reply of Captain Crawford has been received from Bombay.

3. I have given my best and most earnest consideration to these great questions, sensible of the responsibility which attaches to the expression of an opinion upon measures that will affect so many and such vast interests; and I now submit respectfully the conclusions I have formed to the collective judgment of the Honourable Court.

4. It will be convenient to treat the several questions that have been raised in these documents in their natural order. I propose, therefore, to advert,

1st. To the question of a general system of railways for India, on which Major Kennedy has dwelt in the memorandum transmitted by the Court.

2d. To the lines required in the Presidency of Bengal.

3d. To those proposed and required in the Presidency of Bombay.

4th. To those projected or desirable for the Presidency of Madras.

5th. To the agency by which the lines shall severally be constructed.

6th. To the general principle which ought to be observed in the construction of them.

7th. To the particular companies which seek permission to undertake them.

5. It cannot be necessary for me to insist upon the importance of a speedy and wide introduction of railway communication throughout the length and breadth of India. A single glance cast upon the map recalling to mind the vast extent of the Empire we hold; the various classes and interests it includes; [the wide distances which separate the several points at which hostile attack may at any time be expected; the perpetual risk of such hostility appearing in quarters where it is the least expected; the expenditure of time, of treasure, and of life, that are involved in even the ordinary routine of military movements over such a tract, and the comparative handful of men scattered over its surface, who have been the conquerors of the country, and now hold it in subjection:] a single glance upon these things will suffice to show how immeasurable are the political advantages

advantages to be derived from a system of internal communication which would admit of full intelligence of every event being transmitted to the Government under all circumstances, at a speed exceeding five-fold its present rate; and would enable the Government to bring the main bulk of its military strength to bear upon any given point, in as many days as it would now require months, and to an extent which at present is physically impossible.

6. And if the political interests of the state would be promoted by the power which enlarged means of conveyance would confer upon it of increasing its military strength, even while it diminished the numbers and cost of its army, the commercial and social advantages which India would derive from their establishment are, I truly believe, beyond all present calculation. Great tracts are teeming with produce they cannot dispose of. Others are scantily bearing what they would carry in abundance, if only it could be conveyed whither it is needed. England is calling aloud for the cotton which India does already produce in some degree, and would produce sufficient in quality, and plentiful in quantity, if only there were provided the fitting means of conveyance for it, from distant plains, to the several ports adopted for its shipment. Every increase of facilities for trade has been attended, as we have seen, with an increased demand for articles of European produce in the most distant markets of India, and we have yet to learn the extent and value of the interchange which may be established with people beyond our present frontier, and which is yearly and rapidly increasing.

Ships from every part of the world crowd our ports in search of produce which we have or could obtain in the interior, but which at present we cannot profitably fetch to them, and new markets are opening to us on this side of the globe under circumstances which defy the foresight of the wisest to estimate their probable value, or calculate their future extent.

7. It needs but little reflection on such facts to lead us to the conclusion that the establishment of a system of railways in India, judiciously selected and formed, would surely and rapidly give rise within this Empire to the same encouragement of enterprise, the same multiplication of produce, the same discovery of latent resource, to the same increase of national wealth, and to some similar progress in social improvement, that have marked the introduction of improved and extended communication in various kingdoms of the Western world.

8. If further illustration of these advantages be sought, they will be found in the documents laid before the Honourable Court. "The Court itself has recorded its desire that India may, without unnecessary loss of time, possess the immense advantage of a regular and well-devised system of railway communication."

67. 21 Dec. 1852;
para. 2.

9. I trust, therefore, that it may be considered as a matter determined, that the limited sections of experimental line which have heretofore been sanctioned by the Honourable Court are no longer to form the standard for railway works in India, but that these are to be undertaken upon a scale proportional to the extent of the British dominions in the East, and to the immediate benefits they are calculated to produce. I conceive that experimental lines of small extent are at this day no longer requisite.

The mechanical practicability of constructing railways in India needs no further experiment for its establishment. If there are difficulties in India from which railway works in Europe and America are free, India is exempt, on her part, from many great impediments to which those countries are subject. If there are still doubts and difficulties here, which the soil or season of India create, it may now be assumed with confidence that there are none which the skill and experience of those who are charged with the undertaking will not be able to master.

10. Again, the commercial success of railways in India, which the experimental lines were partly intended to test, is, in my humble judgment, not less certain than the practicability of them as material constructions.

Whatever might have been the result of the commercial experiment upon the short section of line which was commenced at Calcutta, if it had not been extended beyond its original dimensions, there seems to me to be no doubt of it

proving remunerative, if it became, as is now proposed, portion of a substantive line towards the North-west Provinces. The amount of traffic which is passed and met by any one travelling upon the great trunk road; the inability of the limited number of steamers on the Ganges to meet the demand for freight; and the numerous river craft which everywhere cover the stream and crowd the canals near this city, through which they communicate with the port; all betoken an amount of goods requiring conveyance, which must be very great in extent. There is no *prima facie* reason to suppose that the parties interested in the conveyance of this mass of goods will not greatly prefer the rapid, safe, and easy carriage of a railway, to the slow and riskful voyage of a country boat. And all the engineers have distinctly stated in their several reports, up to the most recent which Major Baker has submitted, that their constant communications with the natives, with whom they are brought in contact along the country which is to be traversed by the lines, have satisfied them, not only that the natives will gladly use the railways for the conveyance of their goods, but that they will have no scruple in availing themselves of them as passengers, if only the rate of fare paid shall render the carriages available to them.

If the lines shall be judiciously selected in the first instance; well and economically constructed; safely and thrifly worked; I entertain no doubt that upon the great lines of communication now in the contemplation of the company the returns will be remunerative; and that the Honourable Court will be called upon, after a line shall be in full operation, to pay the interest which it has been obliged to guarantee upon the capital, in order to induce the public to invest its money in railway works in India.

11. Were it otherwise, I should still consider it to be the plain duty of the Honourable Company to concede the assistance which is now required of it for the establishment of Indian railways.

Though the lines should not prove clearly remunerative, they will certainly pay in some degree. If the Honourable Company should thus be left liable for some payment to the railway proprietors, still additional means to meet this liability will be afforded by the reduction of public establishments which the introduction of railways will render feasible, though these may not be practicable to the extent anticipated by Major Kennedy in his memorandum; and even if, contrary to the expectations of those who are best qualified to form a judgment upon the subject, the railways should not prove a profitable investment, and the Honourable Company should be called upon to make good yearly a considerable portion of the interest it has guaranteed, the direct advantage it will derive from railways in the reduction of military force, which they will render practicable, and the many other direct and indirect benefits which will accrue to it politically, commercially, and socially, from their existence, will be so great and so palpable as to render the payment of guaranteed interest a burden which the Honourable Company may cheerfully and contentedly bear; more especially when it calls to mind the peculiar relation in which it stands to the people over whom it has been set to rule.

12. Having stated my opinion that the construction of an extensive system of railways in India ought at once to be commenced, and having further expressed my conviction that the lines when fully established will, if prudently and well constructed, be remunerative to those by whom they may have been constructed, and will be productive of infinite advantage to the Government as well as to the community; I have now to suggest the lines which it appears desirable to establish in the first instance.

13. In the memorandum to which the Honourable Court has directed our attention, Major Kennedy has observed, after stating various general principles:

"The first object must be, to lay down the great trunk lines, with a view to the broadest future ramification, and on a principle that shall ensure the most profitable permanent working of the lines generally, bearing at once upon the internal intercourse of India itself, as well as upon the intercourse of India with Europe."

In fulfilment of this object, he proceeds to consider the lines of railway "which would lead to the most perfect and comprehensive system of intercommunication that can at any future time be looked to for India." These he has marked in successive maps in the order in which he considers they should be undertaken, according to the funds that may be available under circumstances which he supposes.

I apprehend

I apprehend that any attempt to lay down this time a perfect and comprehensive system of railways covering the surface of India is premature, and can lead to no practical result. I conceive that my present business is to advise the Honourable Court as to those great trunk lines which are of primary importance, not only as being most immediately required, but as forming the main channels which future lines shall be able to take advantage of, as the best and readiest means of communication with other portions of the Indian Empire.

14. That some such general outline of a system should be described at the commencement, is of essential importance, in order that whatever capital may now be made available for the construction of railways in India may not be frittered away upon local and inconsiderable schemes, but may as far as possible be made to conduce to the establishment of those great lines by which the general interests of India would best be served.

15. The main considerations which should determine the selection of a great trunk line of railway in India must be,

1st, The extent of political and commercial advantages which it is calculated to afford; 2dly, the engineering facilities which it presents; and, 3dly, its adaptation to serve as a main channel for the reception of such subordinate lines as may hereafter be found necessary for special public purposes, or for affording the means of conveyance to particular districts.

16. Tried by these tests, I apprehend that the line from Calcutta by the valley of the Ganges to the North-west Provinces, which is referred by the Honourable Court in the Despatch 87, (1852), will stand the first in order of importance and value, and ought to command the earliest and best attention of the Government of India.

The first portion of the line from Calcutta to Burdwan and Runeegunge was sanctioned some time ago. Its extension from Burdwan to Rajmahl has already been approved.

The engineers of the railway company and the consulting engineer have been engaged during the past season in closely examining the line proposed from Rajmahl to Allahabad.

Their report, which has lately been submitted, is fully satisfactory. Beyond Allahabad the country is known in its general character to be eminently favourable for the formation of a railway, although it has not been minutely surveyed.

With the exception of the rivers which intervene, there is nothing to prevent the prolongation of this line to Lahore and to the river Jhelum, whenever it may be thought desirable so to do; and although the country between the river Jhelum and Attock, in whichever direction it may be approached, will present greater engineering difficulties than the other portions of the line, there is, in my opinion, nothing whatever to prevent the railway being carried to the banks of the Indus at Attock, within 40 miles of our extremest western frontier, whenever it shall seem good to the Honourable Court to order its construction.

17. The line I have sketched, even though it should not be carried at present beyond the river Jhelum, will constitute a very noble work, replete with the highest advantages to the Government and to the public.

18. Viewing it first with especial reference to the interests of the state, I have to observe that it would infinitely diminish the risks, if risks there be, which are involved in the extension of our frontier to a distance of 1,500 miles from the capital of the country. The points on which hostile attacks are the most probable are the Caubul frontier and the borders of Nepal.

19. The hostility of Mahanajah Golab Singh, which has sometimes been anticipated, will most assuredly never be exhibited so long as he has life in himself and strength to prevent its exhibition by others. The interest of future rulers of Cashmere will hardly be less urgent than his to induce them to cultivate friendly relations with the Government of India. If they should not be friendly, neither the wealth and power they hold, nor the character of the people they rule, are sufficient to make them formidable to us.

I regard, therefore, the states of Caubul and of Nepal as the only powers from which hostilities are likely to proceed.

20. The probability of an European invasion by way of Caubul, and by an European force, is so remote as to be hardly more than a bare possibility.

But the probability of an attack from Caubul under European instigation, if circumstances should arise elsewhere to recommend it, especially if either foreign war or internal disorder should, concurrently with such circumstances, compel us to weaken our force in the Western Provinces, is by no means to be disregarded.

21. The state of Nepal is, I believe, at the present time sincerely friendly; but its prince is a nonentity. Its minister, Jung Bahadur, whose personal knowledge of the real power and resources of the British Government forms our best guarantee for the friendliness of Nepal, is, I fear, too far in advance of the public feeling of his countrymen to admit of our regarding his tenure of power or of life as at all secure. Events have already shown that he stands in a perilous position; and if the attempts to destroy him should succeed, trouble upon the frontier of Nepal is not altogether improbable.

22. The distance between the frontiers, which I have indicated as the points of risk, is very great. The European force in the Eastern portion of this Presidency has been for many years past weaker, perhaps, than prudence would altogether warrant.

The recent addition of Pegu, however unwelcome, must be provided for; and while we have only our present force, must proportionably increase the risks of the Nepalese frontier, whatever those may be held to be.

23. Whether, then, hostility shall come from Caubul or from Nepal, the line of railway to which I have referred would be of incalculable value.

Touching every important military station from Calcutta to the Sutlej, connecting every depôt, Allahabad, Agra, Delhi, Ferozepore, with the arsenal in Fort William, it would enable the Government of India to assemble upon either threatened frontier, or, if it were necessary, upon both, an amount of men and materials of war amply sufficient to deal with any such emergency, and within a period which would be measured by days; whereas months must elapse, with our present means, before we could provide the same extent of military defence.

24. Inasmuch as the consciousness of our power thus to concentrate our means wherever we might desire would deter native states from resorting to combined attacks, which they have hitherto happily neglected to attempt, it is probable that the army we now maintain might be numerically reduced without unduly diminishing our military strength.

The weary reliefs of corps periodically traversing long distances, at heavy expense to the state, with grievous loss of time, and occasionally with loss of life, would in a great measure be obviated. The heavy tax upon the people of districts, which is often unavoidably inflicted by reason of the necessity of carriage for the troops, would be removed.

European stores, tending to benefit the health and affect the conduct of our troops, would be easily obtained, quickly and cheaply; and in many various ways, which it is unnecessary to follow in detail, the power of the state would be increased, and its interests materially promoted.

25. The course which the railway would follow for these political purposes is at the same time the very best which it would be possible to select for the interests of trade, and for the local advantage of the whole of this portion of India. The sections that have been already sanctioned open the only coal-field which has yet been brought into extensive operation in Bengal, and afford means of conveyance for the great mass of traffic which, excluded from direct communication with the port of Calcutta by the imperfect navigation of the Nuddea rivers, is compelled, during a great portion of the year, to find its way by the circuitous and inconvenient channel of the Soonderbunds.

The construction of the line to Rajmahl will at the same time afford new and great facilities of carriage for the rich produce of districts that lie upon the left bank of the River Ganges.

Proceeding onwards to Allahabad, the line will skirt the hilly tracts that are now under examination with reference to the mineral wealth they are said to contain; it will open out the opium districts, and will meet the trade of the Nerbudda Valley at Mirzapore, its chief emporium.

Beyond

Beyond Allahabad it will run along the entire Doab, skirting the frontiers of Oude, whose great fertility and natural resources will one day contribute largely to the traffic of the line. It will traverse the country beyond Cawnpore, which, fruitful already, will shortly become more so under the influence of the Ganges Canal, whose opening is looked for in 1854. It may receive, whenever it is desired, a branch by Furruckabad for the conveyance of the produce of Rohilcund; and it will be equally accessible to such other branches as either the Honourable Company or native princes may desire to lead from it into their districts on the other side.

And although the country beyond Delhi is at the present time less productive and less populous than the districts below, no man who has noted the effect which even four years of peace have had upon the face of the country beyond the Sutlej, or who is aware of the vast results which the providing of the means of irrigation produces upon the cultivation and the peopling of similar districts in India, will entertain a doubt of the certain success of those great irrigation works which are already commenced in the Baree Doab, and are contemplated in the Cis-Sutlej province; or of their rendering the districts beyond the Doab, at no distant date, as populous and as productive as those within it.

26. With the prospect of so many and such various benefits to be derived from its construction, I have to recommend that the line of railway by way of the Ganges Valley to the North-west should be completed as far as Delhi with all practicable speed, and that it should thereafter be carried across the Punjab as soon as may be found feasible and expedient.

27. The only local line which is at present contemplated within the Presidency of Bengal is the line from Calcutta to Diamond Harbour.

The object which it is intended to secure by the construction of this line is indicated in the first para. of the despatch from the Honourable Court.

The despatch observes, "Adverting to the difficulties and dangers which attend the navigation of the river between Calcutta and its mouths, it appears to us that these evils would in a great measure, if not altogether, be avoided by means of railway communication, and that such a work would in other respects be productive of much public benefit, and would materially promote the shipping and mercantile interests connected with your Presidency."

In order to enable this Government to give an opinion as to the dangers incurred by trade and shipping in the navigation of the Hooghly, and as to the sufficiency of a railway to Diamond Harbour as a remedy for the evils adverted to, I caused a reference to be made to the Superintendent of Marine.

That officer has submitted a return, showing all the vessels that have been lost in the navigation of the Hooghly during the last 20 years.

They amount to 51 in number. Of these, only nine were lost above Diamond Harbour, all of which were weak and inferior ships.

It further appears that among such ships as have taken the now common precaution of being towed by a tug steamer, only one has ever been lost below Diamond Harbour, and not a single one above it.

These facts, briefly stated, afford the means of effectually testing the value of the present project.

They show that a railway to Diamond Harbour, far from averting "in a great measure, if not altogether," the dangers of the navigation of the Hooghly, would exercise a very small influence over them, for they lie chiefly below Diamond Harbour. They further show that whenever ships have recourse to the usual easy and accessible precaution of steam-towage, the dangers of the navigation are reduced to nothing above Diamond Harbour, and as nearly as possible to nothing below it.

Apprehensions have been entertained that the navigation of the river might be closed altogether by the silting up of the channels near the James and Mary Sand.

No information has ever been before me to show that this is a probable event, or that it has of late years become more probable. Until it does actually occur, or until the probability thereof becomes imminent, or until those huge arks which have been spoken of, and to which Captain Rogers alludes, shall really be the vehicles for the commerce of India, I am unable to advise the construction of a railway from Calcutta to Diamond Harbour.

Fleets of magnificent merchant ships annually come and go uninjured, and

even unimpeded. The fine steam-ships of the Peninsular and Oriental Company habitually run up and down the river safely and at a very high rate of speed. The large mail steamers of the Screw Company, and the heavily armed steam frigates of the Indian navy, perpetually traverse the channel without difficulty or danger.

I do not believe that the formation of a railway to Diamond Harbour would be of the slightest benefit to anyone of these, or that, if it were opened for traffic to-morrow, it would induce any one of them to anchor there, or to depart from their usual plan of proceeding direct to this city, with the advantages of proximity to their cargo and agents, of accessibility to their passengers, and manifold other conveniences, both for those who belong to the ships and for those who are on shore.

I am aware of no benefit whatever which would be derived by the Government from the existence of such a line of railway; nor is it apparent to me in what other respects it would be productive of benefit to the shipping and mercantile interests of this Presidency.

If, however, those interests are of opinion that a railway to Diamond Harbour would be advantageous to them, I respectfully submit that the proper course is that their own enterprise should provide the line for their own advantage. It would be a line of limited extent, of very easy construction, for there does not appear to be any formidable engineering difficulty in its course, and cheap, excepting where it would be necessary to purchase land in the immediate vicinity of Calcutta. The project, therefore, would be easily accomplished by a very small exertion of enterprise and a comparatively small amount of capital.

As the dangers of the navigation do not loudly call for this line, as the interests of the Government would in no respect be promoted by it, and as it is quite within the ordinary compass of joint-stock undertakings, I beg leave to express very strongly my opinion, that it should not be taken in hand by the Government of India, and that, if private parties should engage in it, the Honourable Court should not come under the obligation of guaranteeing interest upon the capital raised for it in any amount whatever.

With reference to the observations of the Superintendent of Marine upon Chilk Lake, I have only to remark, that it is so little of a practical question at the present moment, that I do not think it necessary to occupy the time of the Honourable Court by entering upon a consideration of it.

28. The next important point for consideration, is the desirableness of connecting the several Presidencies by means of railways, and the best mode of effecting the communication. I attach no great value to the connexion by railway of the several capitals and seats of Government, considered merely as such. But it appears to be of the first importance to connect the several Presidencies by a line of rail, each with the other, and to unite Hindostan and the districts to the north-west with the western ports in the Peninsula.

29. The memorial of the directors of a proposed company for constructing a line from Bombay *via* Baroda to Agra, which has been transmitted for the opinion of this Government by the Honourable Court, communicates very fully the several political and commercial purposes which would be served by their project. Although their case seems to be somewhat overstated, and although I do not concur with them in thinking that Simla must ere long become "the permanent residence of the general Government of India," or recommend that it should be so, I am strongly of opinion that the formation of some line uniting Hindostan with Bombay is immediately desirable.

30. Whatever strength there may be in the arguments by which a general line through Hindostan has been urged on political grounds, they bear as strongly in favour of a junction line with the Presidency of Bombay. The military power of the Government of India would be incalculably advanced thereby.

The Presidency of Bombay may be said to have no foreign frontier, except in Scinde.

The Nizam is a foreign potentate, but wholly helpless in our hands.

Of the Rajpoot States, none are hostile, or in the least likely to become so.

Mosht

Most of them furnish a contingent force in some form, officered and controlled by the British Government, which is stationed within their bounds, and forms an effectual check upon them. Even if they should become hostile, the experience of a century has shown us that the danger of combination need not be anticipated; while, if it should unexpectedly take place, the force in the Presidency would be amply sufficient to meet it, even though a considerable portion of the army should be detached elsewhere. In taking this view, I assume, of course, that all risk of simultaneous foreign invasion upon the coast will be fully provided against by our fleets upon the sea.

Such being the political situation of the Presidency of Bombay, it would be able to afford with safety to itself extensive and valuable aid to the Government of India, in the event of the Bengal army being suddenly and heavily threatened by any of those very possible events to which I have pointed in previous paragraphs; if only the means of movement for its troops were afforded to it, and a railway were in existence, annihilating the vast distance which separates the two armies, and which deprives them, in a great measure, of all the advantages of mutual co-operation.

Paras. 20, 21.

31. Nor is it in time of war alone that such a communication would be valuable. Heretofore, and until very recently, every recruit that joined his corps from England, every invalid that was sent back shattered to his home, was obliged to travel the long, slow, weary track to Calcutta, however distant the station at which he was placed. Within the last two years, the establishment of steam communication regularly on the Indus has enabled the Government greatly to lessen this evil. The despatch of recruits by Bombay to Kurrachee for that large portion of the Bengal army that is stationed to the westward of the Jumna, and the conveyance of the invalids of the same portion of the army from Ferozepore to the sea, have been a vast improvement. But a railway to Bombay would afford infinitely greater relief to the class returning home, and far greater facilities in favour of those for the first time arriving in a tropical climate.

32. Its advantages might be still further extended, with great economy of time and money, and probably with great benefit to the health of the troops, and consequently increase to the efficiency of the Bengal army. If a line were in full operation, regiments in relief, instead of landing at Calcutta, and having their first introduction to an Indian climate in those districts where its character is the worst, or, instead of landing at Kurrachee, which can only be done at certain seasons of the year, might be shipped for the shorter voyage to Bombay, and, being landed there, might at once be transported by rail to such station in the Upper Provinces as might be thought best adapted for ensuring the health of the corps.

33. Furthermore, I hope before long to see the cost of the conveyance of troops to India reduced by still another step, and the time occupied upon the voyage equally curtailed, by obtaining permission to convey them across the Isthmus of Suez.

At the present time nothing would be gained by such a change.

But when the railway in Egypt shall be completed from Alexandria to Suez, as it undoubtedly will, and if a railway shall be formed from Bombay to Upper India, as I trust it may, a regiment may be carried in steam transports from England to Alexandria, conveyed in 24 hours from thence to Suez, thence landed by the ships of the Honourable Company at Bombay, and moved up to their station in Hindostan by rail, in less time, and with infinitely less trouble, than they now could march from Calcutta to Benares.

The conveyance by rail across Egypt will, I venture to hope, remove any objection which might be felt there to the passage of foreign troops; while, if the permission should be granted, a corps might leave England after the heat of summer was over, and might be quartered before Christmas upon the banks of the Sutlej, without any exposure in its way, and with four months before it of the finest climate under the sun; so that the men would enter upon the first heats of India with constitutions vigorous and unimpaired by the accident of voyage or march.

34. There can be little doubt that, viewed commercially, this line would supersede all present modes of communication for passengers between Hindostan and the sea. Large numbers of persons already take advantage of the steamers upon the Indus; but the port of Kurrachee is closed during the monsoon. A railway would be available at all times. The Indus passage, though better than the state of things that preceded it, is at best a tedious one, occupying some weeks: the railway would place travellers at Bombay in as many days. These steamers on the Indus bring up European stores and goods far faster and safer than the native boats that preceded them. The bullock-train in the Upper Province, now extended to Calcutta, is a great advance on the hackeries before it. But in either case months elapse before either traders or individuals can obtain the articles on which they are dependent for their business or their comfort. Here, again, the time in which they would be supplied by railway would be measured only by days. And although, of course, the construction of a line from Calcutta would in like manner afford the conveyance for goods which they require, the line from Bombay, communicating through Egypt with England, would be shorter and speedier, and, by virtue of competition, probably as cheap as that through Bengal; while European goods conveyed direct to Bombay by sea would, I apprehend, be able to enter the markets in Hindostan at an advantage as compared with similar goods by way of Calcutta.

35. On these grounds, I consider that a line of railway connecting Upper India with the Western Ports and with the Presidency of Bombay, would be of great political and commercial value, and I beg leave strongly to advocate its construction.

36. The specific course which such a line should follow, it is hardly possible as yet to decide.

The Company, whose memorial has been addressed to the Honourable Court, projects a line by way of Baroda and Neemuch to Agra, commencing for the present at Surat, and leaving the link between that city and Bombay to be constructed the last in order.

There can be no doubt, I think, that on political grounds such a line would be the best, as it would be also the most direct. But it would doubtless be contended by many, that the commercial advantages of a line which, commencing at a point near to that contemplated by the memorialists, should be carried up the valley of the Nerbudda, and, joining the Bengal Railway somewhere near Mirzapore, should thus follow the natural course of the present trade, while it opened up the coal fields known to exist; and the productive resources of that extensive and fertile valley would be so superior to the line by Neemuch, as to recommend it as the first to which capital should be applied.

I entertain little doubt that one day both of these lines will be formed. If one only can be obtained, then, although the line by the Nerbudda would open a communication with Hindostan circuitously, I am of opinion that the line by Baroda and Neemuch would be preferable, so far as we are at present able to judge, and should be selected for construction, if it should be found on examination a practicable and eligible line.

37. This condition is necessarily attached to my recommendation, because at this moment the Government of India has no knowledge of the character of the line, excepting that which it can obtain by looking at the map. The memorial of the Company which proposes to undertake it, gives no information whatever. It proposes, indeed, that the maximum cost per mile shall not exceed 5,000*l.*, exclusive of the crossing of great rivers; but it quotes no survey, adduces no facts, and, in short, supplies no evidence whatever to show that the line can be constructed for that, or for any other sum.

I repeat, therefore, that I advise the construction of a line from Surat, by Baroda and Neemuch, to Agra, as being calculated to afford the greatest amount of general advantage, if, on survey, it should be found that the work can be executed upon any such terms as those contemplated in the memorial of the Director of the Baroda and Central India Railway Company.

38. I would further observe, that the omission or the postponement of the link between Surat and Thanna (or Bombay) appears to me to be a great imperfection

imperfection in the proposed scheme. No doubt the connexion of the line at Agra with Surat on the coast would of itself be a great gain; but the work would be very incomplete until it were extended so as to communicate uninterruptedly with the harbour of Bombay.

39. The memorial does not state whether the Company has taken, or intends to take, any measures for the survey of this line during the ensuing season. A knowledge of the engineering character of the different channels by which Bombay might be approached from Hindostan, is very urgently required; and I would propose that arrangements should be made during the summer to commence a general survey of these two lines in the autumn, if the Railway Company should not have taken measures for that purpose, or unless the Honourable Court should instruct us otherwise.

40. I have now to enter upon the consideration of those lines in the Bombay Presidency upon which the Honourable Court has required the opinion of the Government of India, with especial reference to the remarks contained in the memorandum by Major Kennedy.

A line has already been constructed from Bombay to Thanna, 24 miles in length. This point must be common to all lines entering the island of Bombay, whatever may be their direction. An extension of this line to Callian, to the eastward of Thanna, has been sanctioned. From Callian three lines of railway have been submitted for consideration.

1st. The Thull Ghat line, carried in a north-easterly direction by Nassik into Kandeish, with a view to future prolongation onwards.

2d. The Bhore Ghat line, carried in a south-easterly direction to Poona, with anticipated extension to Ahmednuggur, &c., and as the probable course of a junction line with Madras.

3d. The Malsej line, carried in an easterly direction between the two others to the table land.

Report engineer
Great Indian Pen-
insula Railway
Company, p. 726.

All of these, as their names imply, mount the Ghauts of the Syhidree Range, 1846-1847. The Thull Ghaut and Bhore Ghaut lines were proposed a few months ago.

Upon closer examination of it, all parties concerned, the Great Indian Peninsula Railway Company, the Government Engineer, and the Government of Bombay, concur in recommending the total abandonment of the Malsej Ghaut line.

When I observe that, at the lowest calculation, it could not be opened for through traffic for 17 years to come, it will be thought that I have stated sufficient ground for concurring in its abandonment, without entering further into the many good reasons which are given for that course in the very full reports of the railway and the superintending engineers.

The question, then, for consideration relates only to the Thull Ghat and Bhore Ghat lines.

41. The superintending engineer, in his observations upon the memorandums of Major Kennedy, writes thus:—

"20. It will be seen from para. 30, and also from the opening of Appendix No. 3, that Major Kennedy is not aware that the whole project for reaching the table land of Candeish by the Malsej Ghaut route has, after a most careful reconsideration and survey of other routes, been rejected for that by the Thull Ghaut, and there is no intention now of attempting the ascent by a fixed engine incline of about six miles, with a gradient of about 1 in 18, or by an alternative incline of 13 miles long, with a somewhat reduced gradient." All exceptions, therefore, taken by Major Kennedy to these points, or to the branches north from Alleh to Kandeish, and south-eastward to Sholapoor, are now of no force. Neither is it the intention that the grand trunk line between Bombay and Agra "should pass over no fewer than four unnecessary and fierce ranges of mountains;" indeed it is no object, at any rate at present, with those in Bombay interested in railways to look towards Agra at all. Our object is to reach the table land of the Deccan and Candeish as speedily as possible; and this I am fully persuaded is provided

for in the project now before Government in the report forwarded by the Railway Company.*

42. In these remarks it does not appear to me that the superintending engineer has fairly met the main objections to the Bombay lines set forth by Major Kennedy.

That objection, broadly stated, is, that it was a grave error to propose that "the grand trunk road by which the whole northern, north-western, and north-eastern traffic is to approach Bombay, the important mercantile capital of Western India, should be carried over the Syhadree Ghats."

Letter, para. 21,
31 January 1853.

The remarks of Captain Crawford, which I have quoted, would appear to imply that the lines now projected have no other object than "to reach the table land of the Deccan and Candesh as speedily as possible." It appears, however, from other passages in the documents communicated from Bombay, that their views regarding the Thull Ghat line are not limited to this local object.

Para. 61.

Later in the same letter, Captain Crawford remarks, "The country onwards from Candesh appears to offer every facility for the extension of the line to the eastward, so that we may hope to fall in with the Calcutta line in its extension to the north-westward, and thus complete the communication between Bombay and Calcutta by rail—a result looked forward to, I imagine, with much greater anxiety by the mercantile interests in Bombay than a present communication with Agra."

Report, 7 October
1852, para. 23.

Again, in his Report to the Government of Bombay, the superintending engineer gives it as his opinion, that, "looking at the subject in every point of view, there can be no doubt that, as a grand trunk line for India, the route by the Thull Ghat is to be preferred to all others."

This view is advocated also by the engineer of the Railway Company: he says—

Mr. Barker's re-
port, 14 September
1852, para. 223.

"It would be a part of the most practicable and convenient line for Oujein, and the Province of Malwa, with its opium trade, and for the North Western Provinces of Bengal: it would be the shortest route for the produce of the Nerbudda Valley, with its coal-fields of Baitool and Bewas, and lie, in my opinion, in the proper direction for the trunk line to cross the Peninsula."

These passages demonstrate, that, in laying out the Thull Ghat line, both the Railway Company and the Government engineer at Bombay contemplate it as the great trunk line for India, which shall open Malwa, the Nerbudda Valley, the North Western Provinces of Bengal, cross the Peninsula, and connect Bombay with Calcutta.

Whether, then, the lines now proposed at Bombay are or are not directed precisely to the point mentioned by Major Kennedy, namely, Agra, they are recommended as great trunk lines to traverse India, and convey the "northern, north-western, and north-eastern traffic" to Bombay.

Whether they do or do not literally "pass over no fewer than four unnecessary and fierce ranges of mountains," they cross the Syhadree range, and other ranges and valleys in the route anticipated for them.

Wherefore the lines now proposed are substantially liable to the main objection advanced against them in the memorandum in like manner as the Malsej Ghat line, to which it appears that Major Kennedy referred.

43. The practical question for determination is this: is the Thull Ghat line so strongly urged by the Great Peninsula Railway Company and the Government of Bombay well fitted to be a great trunk line connecting that city with Hindostan and Bengal, and serving as the channel for conveying the trade of Northern and Central India to the western port?

I have no hesitation in expressing a decided opinion that the Thull Ghat line, as at present before this Government, is in many respects highly objectionable, and ought by no means to be adopted by the Honourable Court as a great trunk line for communication with the rest of India, unless it should appear that nature has denied us the possibility of finding a better, which I do not believe to be the case.

44. In

* With letter, No. 548, dated 27 September 1852; copy sent to Government of India, with letter No. 450, dated 15 October 1852.

44. In support of this opinion, it is necessary to advert shortly to the character of the line as shown in the engineer's report, and in the tables of gradients and curves appended.

Leaving Callian, it runs straight at the Ghaut in the Syhadree range, which it is intended to surmount by a steep incline.

For 18 miles out of 28, before it reaches the foot of the incline, it rises at a gradient of 1 in 100.

It mounts the incline at a continuous gradient of 1 in 37, for nearly seven miles. This, however, is not its most objectionable feature, which is to be found, as the engineer points out, in the concurrence with this steep gradient of "sharp reverse curves" of 32, and even 30 chains radius.

The railway engineer admits this feature to be objectionable; but he affirms, from the experience upon inclined planes of a similar character in England, "that this one may be worked efficiently by locomotive power."

Report, para. 168.

The superintending engineer, quoting the opinion of the engineer as to working a train up this plane by locomotive power, observes, "I must confess, however, that the working the down line on such an incline appears to me almost as difficult a problem as getting the traffic up it."

Report, para. 27.

The railway engineer proposes to effect this solely by the use of ordinary breaks, and he refers largely to the Lickey incline, in proof that it can be safely done. Both planes are at 1 in 37; but the Lickey incline is two and a quarter miles in length; the Thull Ghat incline nearly seven miles; and moreover, as the superintending engineer justly observes, the Lickey incline "has not curves of 30 chains radius upon it."

Para. 27.

The superintending engineer proposes to meet this difficulty by "the principle of the atmospheric railway reversed." I am not sure whether I understand this proposal correctly, when I assume it to mean, that the speed of the descending train is to be checked by the repelling pressure in the atmospheric tube, in the same manner as the pressure has usually been employed for propulsion. If so, with complete deference to opinions better than mine, I must needs say, that, according to existing experience of atmospheric railways, this seems to me to be a desperate nostrum.

It is now a good many years since an opinion unfavourable to the atmospheric lines was expressed by the Railway Department at the Board of Trade. Like many other opinions which proceeded from the department, this one was overruled by Parliament. Atmospheric lines were constructed; one to Croydon; one, I think, in Devonshire. The result of the Croydon line (and I believe of both) was a total failure. Those who were to travel the South Eastern Railway will remember the very common spectacle of the carriages standing on the atmospheric line motionless, for want of power to move them. And all who do so, will feel, as I do, some consternation at the thought of what would be the consequence of a similar failure of power in the Bombay atmospheric line, when a train should be descending the Thull Ghat, in a gradient of 1 in 37, with curves of 30 chains radius, for seven miles together. On the Croydon line, in such a case the train simply stood still; on the Thull Ghat it would be, I apprehend, in a vastly less secure position.

45. Such is the character of a line over which all the goods and passengers traffic from Calcutta and the North Western Provinces of Bengal, the corn and coal of the Nerbudda Valley, the opium of Malwa, and the cotton of Kandeish are to pass; and which the superintending engineer at Bombay considers, "there is no doubt," in every point of view, "is," as a grand trunk line for India, "to be preferred to all other routes."

I am unable to concur in this view.

It may be, that full and searching examination of the country may prove that its nature will not admit of any better approach to Bombay being found than this which is recommended by the Thull Ghat. It may turn out that a trunk line to Hindostan and to Bengal by Baroda, or by the Nerbudda Valley, can only be constructed at such great additional cost, or with such great increase of extent, as to render it less profitable than the Thull Ghat line would be, notwithstanding the objections that may be stated to the latter. In such case it would doubtlessly be advisable to sanction a "grand trunk for India" by the Thull Ghat. But unless this should be shown, which I do not believe to be probable, I respectfully advise the Honourable Court not to give their sanction to the Thull

Ghat line in the character of a main trunk communication between the western coast of Bombay and Hindostan, or Bengal.

46. It does not necessarily follow from the rejection of the Thull Ghat as a great trunk line, that its construction as a local line should be prohibited.

Mem. para. 33.

Even the memorandum by Major Kennedy (whose doctrines regarding gradients go beyond the opinion I hold, and will be considered in another part of this minute) fully admits that "there is no doubt the interests of the table land east and south-east from Bombay call for every exertion to open a passage through the Syhadree range."

The report of the railway engineer, confirmed by that of the superintending engineer, appears to me to establish the great commercial importance of opening as soon as possible a channel for trade into the table land above the Ghats. The practicability of it is established. Its remunerativeness seems, at least, to be highly probable.

Of the two lines proposed, that in the direction of Kandeish appears to be of the greater commercial value. That in the direction of the Poona has considerable political value, and it is not without commercial value; but in this latter respect it appears to be inferior to the Thull Ghat line.

The value of both, however, upon political and commercial considerations, seems to me to be so satisfactorily established, that I venture to submit to the Honourable Court a recommendation that both should be undertaken on such favourable terms as it is probable may be obtained.

An extension in one direction or the other is clearly necessary, if the portion already sanctioned as far as Callian is expected to pay. If only one project meets with favour from the Honourable Court, I am bound to say, notwithstanding the advantage politically of connecting Poona with Bombay, that I think the Kandeish line is, upon the whole, entitled to the preference.

47. Although I conceive that the Kandeish line is the more valuable of the two, and have recommended it for preference, I cannot recommend that it should at once be sanctioned by the Honourable Court as it now stands.

Concurring with Major Kennedy in the general principle which he lays down (as I shall elsewhere more fully explain), I cannot go with him through the whole extent to which he has carried them. Guided by the information I have obtained from the able and experienced officers who have been appointed to advise the Government on railway questions in each of the three Presidencies, I must express my conviction that such gradients as 1 in 2,000 for first-class, 1 in 330 for second-class lines, on which he inflexibly insists, are physically unattainable in the Presidency of Bombay, as well as of Madras.

Neither can I give my assent to the whole views he has expressed regarding the Bombay lines. The superintending engineer has shown, I think very clearly, that in the general rules which he has thought capable of observance upon Bombay lines, and in his scheme for surmounting the Ghats by lines free from the objections that are applicable to those proposed, Major Kennedy has written without sufficient practical and personal knowledge of the facts, and has fallen into error. The discussion is a professional one; and I venture only with great distrust of myself to give an opinion at all upon the question at issue. So far, however, as I may venture to do so, I must say that I think Captain Crawford has shown that the Ghats of the Syhadree range cannot be ascended in the manner or at the cost asserted by Major Kennedy.

Again, I conceive that Captain Crawford has built up a very strong presumptive case against the practical correctness of Major Kennedy's opinion, that Candesh ought to be opened up by a railway, taking the line of the Taptee river. The length of such a river line is shown to be very much greater: the difficulties of construction would apparently be very serious, and the sources of traffic along it few and scanty.

But although I consider that the Ghats, if ascended at all, must be ascended at gradients far less favourable than those which Major Kennedy's views regard as the worst admissible, and although I think that, as the case stands at present, the Thull Ghat line, faulty as it is, may perhaps prove to be a more profitable line whereby to connect Candesh with Bombay than the line of Taptee River, still I am of opinion that the Honourable Court ought not to jump to a conclusion, and to sanction the Thull Ghat even as a local line, until further examination

nation shall have been made, and an authoritative comparison instituted between the Ghat line and the river line.

Both parties are at present proceeding on assumption; neither have examined the line which they respectively commend and condemn.

I recommend, therefore, that before the Honourable Court shall sanction the Thull Ghat line at all, they should require an accurate survey of the Taptee line, with a view to determine which of the two will be the more profitable and the more generally valuable to the interests of India.

48. Though the decision were already given in favour of the Ghat line as against the river line, I should further recommend the Honourable Court not to sanction the Thull Ghat Railway, over which it is probable that a very large commercial and passenger traffic will be conveyed, until further examination of the Syhadree range shall have shown that the Ghaut actually selected is the most favourable one in an engineering point of view by which a railway could reach the table land towards Kandeish. I apprehend that it is in no way essential that the railway, in mounting the Ghauts, should closely follow the road over which the traffic now travels. If the line shall penetrate anywhere by the Ghats, the country from which the produce comes, I conceive it will readily draw the traffic to itself.

These observations apply equally to the Thull Ghat and Booree Ghat lines.

The engineering character of the former has already been adverted to.

The latter presents also some startling characteristics.

Nearly six miles of its length are upon a gradient of 1 in 37, of which nearly two miles are at no more than 1 foot in 20; and curves of 30 chains radius occur in this incline, as upon the other.

49. I repeat again, nature may have decreed that we must scale this gradient, or be excluded from the table land. If so, doubtless such obstructions to ascent must be submitted to; but they ought not to be submitted to until submission shall have been proved to be inevitable. A gradient of 1 in 20 for two miles should not be sanctioned, unless the engineers are in a condition to affirm that the Syhadree range nowhere affords a Ghaut more easy of access in the direction required. That the engineers are not in a condition to say this, we know upon their own authority with respect to both of the lines they now recommend.

Mr. Berkeley says, regarding the Bhoore Ghaut, "It would be unreasonable to conclude that in one short season of four months, and with very limited assistance, I have been able to select a line up this Ghaut which would not admit of considerable alterations and improvements. On the contrary, the minute study of the country which Mr. Sandum has made in obtaining the present section, led us to discover the means of improving the objectionable parts of that section as soon as its completion made us aware of them."

Report, para. 120.

With reference to the Thull Ghat line, he in like manner remarks, "In the case of this, as well as of the Bhoore Ghaut, it cannot be expected that in the course of the last short season we should have been able to select the best line in all its details that the ground admits of."

Report, para. 171.

A reference to the context will show that in both cases the engineer feels confident that better inclines will be found. The superintending engineer, commenting on these passages, expresses an expectation that a further examination will get rid of many of the heaviest works, and especially of the incline of 1 in 20.

There is no reason to doubt that the engineers did the utmost that men could do within the time allowed. But I submit to the Honourable Court that when the engineers themselves plead insufficiency of time for examination, and when they express confident belief that better access to the table land can be found, the immediate sanction that is asked for schemes which are thus avowedly crude, ought not to be given. I submit that the sanction should be withheld, not only till a more perfect examination shall have been made of the particular Ghauts selected, but until that full examination of the general range, which is not shown to have been made, shall have been completed, and until the engineers are in a condition to certify that the Ghauts selected are the best available for the object in view.

50. I advise this course the more, that on the other side of India, where approaches are being sought for railways to the same table land, Major Pears, the consulting engineer to the Government, has found both the Ghauts that are best fitted for the purpose in view after separate examination, and away from the immediate course of traffic as it flows at present.

51. The record before me shows, I think, the necessity of these precautions.

The Malsej Ghaut line was examined in 1846-47 by Mr. Chapman, surveyed, recommended, and adopted by the Court. It is now very properly rejected, a few years after, as it has been found, on further examination, that it would take at least 17 years to complete it, and that it is, as Captain Crawford succinctly describes it, "not only ineligible, but economically impossible."

52. I beg leave to represent the expediency with respect to the Thull Ghaut and Bhore Ghaut lines of that complete examination of the lines, and of the rest of the range, which does not appear as yet to have been given to them, and which, if it had been afforded to the Malsej Ghaut line formerly, would have prevented such facts appearing upon record regarding railway schemes as are contained in the papers before me.

53. I am aware that the course I respectfully recommend involves delay, and I am aware that the superintending engineer, and the Government of Bombay, strongly deprecate delay. Captain Crawford urges that "the work should be pushed on beyond Callian at once," lest capitalists at home should be intimidated, and natives should lose confidence in railways in general, and the Government of Bombay endorses the sentiment.

I humbly conceive that, in dealing with so large a matter as railways for India, it is our duty to look beyond the interests and the impressions of the moment. I apprehend that capitalists at home are more likely to be intimidated, and natives to be discouraged, by discovering some years hence that we have adopted, as was done in the Malsej Ghaut Railway, a costly and a bad line, when a more deliberate inquiry would have improved the actual line, or would have guided us to one altogether better, than they are likely to be alarmed by a prudent delay, incurred for the purpose of testing the soundness of the undertaking we are engaging in, and of taking reasonable care to ensure that it shall ultimately prove a profitable one. Such a delay need not be a prolonged one, and most certainly is not a superfluous precaution.

54. The sum, therefore, of the recommendations which I have the honour to submit regarding the lines projected in the Presidency of Bombay, and on which the opinion of the Supreme Government was required by the Honourable Court, with especial reference to the remarks of Major Kennedy upon them, is:—

1st. That the Malsej Ghat line should be wholly and finally abandoned.

2dly. That the Thull Ghat line should not be adopted as one of the great trunk lines for India, unless the examination I have already advised shall show that a better and more profitable line is unattainable.

3dly. That line opening a way from Bombay to Candesh and to Poona respectively shall be sanctioned.

4thly. That the Thull Ghat line to Candesh shall not be sanctioned until a survey shall have been made of the line recommended by the Taptee, and the Honourable Court shall have decided between the Ghat and river lines.

5thly. That neither the Bhore Ghat line to Poona, nor the Thull Ghat line (if it should ultimately be decided that Candesh should be reached by a Ghat line) shall be finally sanctioned, until it shall have been ascertained by full survey that no better entrance to the table land north-east and south-east of Bombay can be found than those two Ghats respectively, and until further survey of the Thull Ghat and Bhore Ghat lines shall have been made, with a view to determining specifically those modifications of the objectionable features of both lines which the engineers appear to be confident of effecting.

55. It is now to be considered whether the Presidency of Madras can be included in any general system of continuous railways in India, and what lines should be constructed therein.

The

The connexion of the capital of the Madras Presidency with the seat of the Supreme Government, is of even less importance than a direct connexion between Bombay and Calcutta.

Madras does not, like Bombay, receive earlier intelligence from Europe, and it is considerable only so far as regards the Presidency itself. Any intelligence of moment will be communicable from Madras by the general line of electric telegraph now about to be formed, and will be conveyed to the Supreme Government within a very short space of time, even though the wires should not be carried direct between the two cities.

56. The line of railway which is laid down in Sketch No. 3 of the scheme transmitted to us, and which runs along the coast during its whole course, would, I apprehend, be very inexpedient at present, or until the circumstances of the country through which it would pass shall have become very different from what they now are.

This line would be of great length, and costly in construction. It passes through a country having little produce and little trade, bordered in many parts by jungles, which are even now unexplored. Along its whole course, from Madras to Calcutta, it would be worked in competition with the sea; a highway which, in this case would be so comparatively easy, speedy, and cheap, as to be sufficient for all public purposes, and to render it preferable for all present commercial ends.

I therefore do not recommend that a line from Calcutta to Madras should be taken into consideration.

57. The junction of Madras, however, with the main line already recommended for Bombay, and thereby with the main line in Hindoostan, would be of value.

The Presidency of Madras is even more unembarrassed with foreign frontier than the Presidency of Bombay. It contains seven regiments of European troops, and a numerous native army. At present this large force is in a great measure isolated, so far as the other portions of the continent of India are concerned. If, however, Madras were brought into direct communication with Bombay by means of a line of railway, the military power of the British Government throughout India would be thereby still farther enhanced, and its means of prompt and concentrated action most materially increased.

I apprehend also that the formation of this line direct to the great port on the western coast would be of much value to Madras in its communications with Europe, and probably in its general commerce.

58. The junction of Madras and Bombay is contemplated in the scheme to which I have referred. Major Kennedy proposes to effect it by a line carried along the coast as far as Rajahmundry, and thence following the course of the Godavery through the territories of the Nizam, and through Candeish to Surat.

With reference to this line it is observed, "a feature of much general importance in our present consideration is the great central Omerkuntur table land. It sheds its waters in every direction to the south-eastward by the Gunga, Godavery, Mahanuddy, &c., which flow to the Madras coast."

Para. 53, 54-

"Keeping these great geographical features in mind, and they cannot be overlooked in any general project without fatal error, they force upon us the knowledge of what the great arteries of commerce must necessarily be, and with those great arteries our trunk roads must correspond."

59. Upon these questions I have endeavoured to aid my judgment by conference with the consulting engineer of the Presidency of Madras. Upon the principle above enunciated in the memorandum, and upon the junction line between Madras and Bombay proposed in accordance with it, Major Pears has observed as follows:

"Now the rivers in the south are not, and never have been, the great arteries of commerce; all those rivers upon which Major Kennedy has marked lines. The Godavery, the Kistnah, the Pennaar, the Palaar, and the Cavery, exhibit in different degrees the same characteristic features. They rise on the table land (some at the crest of the Western Ghats); they pass over it, by a course more or less circuitous, till they reach the eastern limit of that table, and they then plunge on to the Coromandel plain, either falling over abrupt Ghats, or by a hurried and very tortuous course among an uninhabited or very thinly-peopled range of rugged hills, covered with forests. Some of these rivers are dry during

Para. 22, 23, 24.
27.

a great portion of the year, and all are subject to very great variations in their volume of water."

"23. It is manifest that such streams as these cannot affect the condition of the people, or the country, as do the Ganges, the Indus, and the Nile. In the Ganges we see a large volume of water all the year round, serving as a great highway for the people. A broad and fertile valley, subject annually to the fertilising influence of this noble stream; and the people clustering in large numbers on its banks, exhibiting, in every possible way, their appreciation of the benefits they receive from it. Here, then, we have a great artery of commerce, and we must recollect it has become so, not merely because the country drains down the valley, but because that valley, and the stream which flows down it, are favourable to the ordinary commercial, manufacturing, and agricultural pursuit of mankind. The traffic to which the Railway Company look for their dividend is greatly due to the river in its operations as a highway. We may take encouragement from this in other parts of the country where the traffic is now less, and trust that, denied as they have hitherto been, the great advantages of cheap transport, the railways may do for them what the Ganges has done for Bengal."

"24. The Mahanuddy, the Godavery, the Kistnah, are rivers, as I have above shown, of a different character. Instead of being the great arteries of commerce, no populous or busy towns are found on their banks during their whole length. Instead of passing through a dense and industrious population, their course for several hundred miles lies through a region of mountain and forest, where the sound of man's voice is never heard."

"27. One more observation may be made upon this point, viz., that these streams do not necessarily give us good gradients, unless by a sacrifice in length and straightness. If we take any plain, such as that of Coromandel, inclined generally to the sea, at such an angle that a direct line drawn across it perpendicular to the coast would fall 10 feet in a mile, the general course of a river will have precisely the same fall, and it is only by following the numerous sharp sinuosities of the river, and so proportionately increasing our distance, that we could reduce the fall to that of the river's bed."

60. Having regard to the information thus afforded regarding the physical character and present condition of the country through which this line would pass; considering that it would extend to not less than 1,200 or 1,300 miles; and that in a great portion of its course it must traverse the territories of his Highness the Nizam, who, not improbably, might object to it altogether, or, if he did not, would certainly be a great impediment to the undertaking, I am of opinion that, as at present advised, the Honourable Court should not entertain any project for a railway between Madras and Bombay by the line of the River Godavery. I have the less hesitation in offering this opinion, because there seems every reason to believe that a junction line may be found free from the objections to which the Godavery line appears subject, of much less extent, and well calculated to promote the political and commercial purposes which, in deciding upon general lines, are to be steadily kept in view.

61. The several reports of Major Pears to the Government of Madras give a full, clear, and well-weighed statement of the subject, as connected with that Presidency, whose peculiar physical character introduces important elements into the consideration of the question of railways in India.

Having studied it with the advantage of personal communication with that officer, and to the best of my ability, I venture to express an opinion that the main lines immediately required in Madras may be indicated in general terms with safety.

62. It appears to be established with certainty, that there are two great lines of commerce towards the city and port of Madras. The one approaches from the northward, bringing down the rich produce of the ceded districts, and of the country by Cuddapah, and beyond it. The other comes in from the westward and southward, by way of Arcot, Vellore, Vanienbady, Salem, and so on towards Coimbatore, &c.

The Government of Madras have already selected the first portion of the second of these as their experimental line. On a reference directed by the Honourable

Honourable Court, the Government of India has seen cause to concur with the Government of Madras in their selection of this portion, and it is already in progress.

I have the honour to advise that this line should be one of those selected for construction in the Presidency of Madras, and that it should be prolonged by Salem to Coimbatore, and through the gap in the Ghats at Paulgancherry, to the opposite coast. A branch should be thrown off to Bangalore, which Major Pears entertained a hope of being able to effect satisfactorily, by way of a Ghaut beyond Vanimbudy. A branch might be carried with advantage to the foot of the Neilgherries, near to Ootacamund, and ultimately, perhaps, Cannanore might be included by means of a short extension.

The reports of Major Pears afford the means of forming a judgment upon this, as a commercial line, so fully, that I should waste time in repeating his facts in this paper. In a political point of view its advantages are obvious. A large military force is habitually stationed at Bangalore, to which it is proposed to run a branch. Another European regiment is stationed at Cannanore, and one is likely to be placed at the sanitarium in the hills. The proposed line of rail would touch all of these points, and would enable the Government of Madras to collect its main force rapidly at the capital, either for its own purposes, or for the assistance of the Supreme Government, by embarking and de-patching troops to Calcutta, or to the Eastern Provinces across the Bay, as occasion might require.

63. Since his return to Madras, Major Pears, at my suggestion, has made a rapid survey of the line by Cuddapah, towards Bellary, upon which, it has already been stated, that the main stream of traffic flows to Madras from the northward, and on which cotton, especially, is largely grown. It is satisfactory to learn, that he has found much less engineering difficulty upon this line than his general local knowledge had previously led him to anticipate, and that he now sees reason to believe that a good line may be found by Cuddapah onwards.

Further examination is being made. If it should confirm Major Pears' present view, I advise that this line also should be undertaken.

Its commercial properties have already been pointed out, and it will bring the military station of Bellary into direct communication with the capital, still further strengthening the political considerations that have been urged in para. 62 on behalf of railways in Madras.

64. It still remains to determine whether a junction line with Bombay can be found, that by the Godavery having been rejected.

It has been suggested that the line by Vellore and Coimbatore to Calicut might be carried thence along the coast of Malabar, and Canara to Bombay, and would be eligible as a main line, by reason of its escaping the necessity of rising up the Eastern Ghats, and again descending upon the west, by passing through the gap at Palghautcherry.

I have been able to obtain no accurate knowledge of the character of this line along the western coast. But it will be circuitous; foreign territory must apparently be crossed or avoided at Goa; and the general nature of the country upon that side of India, and a consideration of its features as they appear even upon an ordinary map, induce me to think that this course ought not to be selected for a junction line with Bombay.

If Major Pears' examination of the Cuddapah country should lead to the discovery of an admissible line as far as Bellary, it will be seen that he contemplates its prolongation from thence up the valley of the Beema to Poonah, where it would join any line which may have been brought to this very important station up the Western Ghats from Bombay. No survey has been made as yet of this line; and it is so far objectionable that it crosses a portion of the Nizam's territory: it does not do so, however, to any great extent, and so far as it is possible to form an opinion, with the very general knowledge of the country which alone has been obtained at present, it appears to be admissible.

I advise that means should immediately be taken in connexion with, and in continuation of the survey of the line from Madras by Cuddapah to Bellary, for the purpose of surveying the country beyond towards Poonah and Bombay. If present anticipations should be at all fulfilled, I conceive that this line would form the best trunk line that can be found for uniting Madras with Bombay, and

with the general system of railway communication throughout the British territories in India.

65. It is very true, that this or any other direct line of junction across the Peninsula, must scale the Ghauts, in order to cross the table land which lies between, and consequently must be inadmissible if the primary principle for trunk lines in India, which has been laid down in Major Kennedy's memorandum, and has been referred for the opinion of this Government, shall be adopted and insisted upon. This general principle shall be presently considered.

In the meantime it must be observed, that it is very doubtful whether any junction line between Madras and Bombay could be found which does not wholly violate, not merely the principle laid down for trunk lines, but also that laid down for second class or branch lines in the memorandum above mentioned.

If such a line can be found and formed, it certainly will only be done at the expense of greatly increased distances, and in all probability of very heavy additional cost.

66. In the preceding paragraphs a general system of railways for India, together with the particular lines immediately required in the several Presidencies, has been discussed.

The agency by which the several lines should be constructed is now to be considered.

I have bestowed upon this portion of the subject my best and closest attention, and have given to it most earnest and anxious thought, for it is a question of the very deepest importance to the Honourable Company, and one upon which differing views are entertained by many, whose knowledge and judgment are entitled to great respect.

67. It is contended by some, that railways in India should be constructed on behalf of the Government by its own officers, who, it is alleged, would execute the works with greater economy, efficiency, and speed, than can be done by the agents of a Railway Company formed in and directed from England.

Others argue that the plan which has already been adopted, of entrusting the execution of railways to incorporated bodies, under the control of the Court, and of the local Governments, should be adhered to in future railway undertakings.

68. With deference to those from whose views I dissent, I have to express a decided opinion that the construction of the works by a Railway Company, under the supervision and control of the Government, is the best system which is open for the adoption of the Honourable Court.

69. Railway works in India will probably consist for the most part of embankments and bridges of various descriptions. These are works with which the engineers in the several armies of the Honourable Company are thoroughly conversant. There can be no doubt, therefore, that railways could be executed by the local Governments with as full efficiency as by the engineers of private companies. Again, the engineers of the Government have had long practice in the construction of such works as form the component parts of a railway, though not in the formation of continuous railway lines. They are familiar with the people and their ways, acquainted with their language, inured to the climate, versed in the machinery of agency, and on their guard against its abuses. Great works exist to testify to their professional ability, and I am not aware of any well-founded allegations of reckless or unthrifty expenditure in the execution of them.

Officers so highly qualified undoubtedly are likely to carry on the works of an extensive undertaking upon the plains of India with greater economy and greater speed than can be possible now, or for some time to come, in the case of men freshly arrived from England, ignorant of everything connected with this country, and sometimes not altogether inclined to learn. And although I have some hesitation in believing that the Government of India is any exception to the general rule which holds good elsewhere, that a Government always works at greater expense than anybody else, and although I am not prepared to say that, during the five years I have passed in India, the execution of the Grand Trunk Road, or even of the Ganges Canal (noble work though it be), has in any respect been characterized by speed, as compared with the execution of corresponding works in other countries; still I do not wish to dispute that railway

railway works may be executed here with greater economy and speed by the Government than by railway companies.

70. But admitting unreservedly that engineer officers would make a railway as well, and admitting, for the sake of argument, that they would make it as cheaply and as quickly as private companies, I am still of opinion that the Government ought not to undertake the making of railways.

71. The Government in these Presidencies is at present deficient in the agency they would require for the purpose. The number of engineer officers is so wholly inadequate for the duties they have to perform, that other officers have been numerous employed in the Department of Works. The Honourable Court has declared its readiness to augment the corps of Engineers; but that measure would not for many years to come diminish the difficulty to which I have referred. Even if the duty of the Government engineer on a railway were solely that of superintendence, a few would not suffice for the work. Many must be withdrawn from the duties on which they are now employed; and it is my opinion that this could not be done without detriment to the general interests of the State. I think it far better that railway works should be entrusted to parties ready to execute them by professional engineers of undoubted competency, under the control of the Government, than that public works in other parts of the country should be starved through the withdrawal of the engineers, for whom no adequate substitute can be furnished, merely in order that the railway works may be executed at something less cost, and in something less time, than European agency would spend upon them.

72. This consideration, however, does not form the strongest objection in my mind to the execution of railway works by the Government of India.

I hold that the creation of great public works, which, although they serve important purposes of State, are mainly intended to be used in those multifarious operations which the enterprise, the trade, and the interests of the community, for ever keep in motion, is no part of the proper business of a Government.

It is very proper that the Government of India should undertake the formation of the Ganges Canal, of irrigation channels, and of tanks in various parts of India. These are works which affect the general well-being of the community, or that of particular districts, and which, producing no immediate return, must be executed by the Government, if they are to be formed at all.

It is very right that the Government of India should have constructed the Great Trunk Road, and would be very right that it should greatly extend the principle on which it has charged itself with that work, because there is nobody else to do such things, and because the Government of India stands in various relations to local interests in India, beyond what it fills as the Executive Government, and beyond what is filled by the Executive Government in our own land.

But the conduct of an enterprise which is undertaken mainly for commercial purposes, and which private parties are willing to engage for, does not fall within the proper functions of any Government.

73. Least of all should it be taken as any part of the business of the Government of India. One of the greatest drawbacks to the advance of this country in material prosperity, has been the total dependence upon the Government in which the community has placed itself, and its apparent utter helplessness to do anything for itself.

Until very recently, the only regular carrier in the country has been the Government; and no man could make a journey but with Government establishments, and by the agency of a Government officer.

It was but the other day that the agent for Lloyd's in the port of Moulmein, where there is a considerable community of European merchants, formally complained that the Government of India did not keep a steam tug to tow their ships to sea for them.

Even in these instances in which something like enterprise has been attempted by means of joint stock companies, the effect has been feeble, and the results insignificant.

For years the Steam Company on the Ganges have complained of the competition of Government steamers; during the last year fully one-half of the Government steamers has been withdrawn; nevertheless, one of the two Steam

Companies has ceased to run; it is so in every thing else; no one seems to have activity enough in connexion with a company even to look after his own interests, and of the few enterprising movements that have been made, fewer still can be quoted as having obtained even a moderate success.

Those cases in which the scheme has been connected with English management, and has been founded on English capital, have made their way, and are prospering. The Peninsular and Oriental Steam Company is an instance of this kind; and its great past prosperity, and the spirit and success with which it is pushing its undertakings with India, and all over the east, are a conspicuous proof of the efficacy of private enterprise, directed by the vigorous control of parties holding an interest in England.

74. When the spirit of enterprise still shows so feebly in India, when the employment of the English capital on a great scale within the interior of this country is so rare, and when there is such good reason to anticipate the best effects from its profitable investment in any one branch of Indian undertakings, by the encouragement that would thereby be given to its introduction through many other and various channels, I submit that it would be impolitic for the Honourable Court to put aside the several associations that are now presenting themselves to compete for the advantage of supplying India with that which she so much needs; in order that it may itself undertake these vast works, on no stronger ground than the assumption (which, after all, is only an assumption), that some little time and money would be saved, I submit, on the contrary, that all the money and time which the Honourable Court may contemplate, being able to save thereby, would be well expended in securing the introduction at this time, of a large amount of English capital and English energy, so as to encourage, by the successful issue which I anticipate for these railway undertakings, a more extensive employment of similar capital, and similar efforts hereafter in connexion with the products and the trade of India.

75. Having explained the grounds on which I formed my opinion, that the construction of railways in India should be entrusted to private companies incorporated for that purpose, a few remarks are necessary respecting the union of private enterprise with Government control, which I have ventured to recommend as the best system which it is open to the Court to adopt.

76. The enlistment of private enterprise for the formation of these great works, directly, but not vexatiously controlled by the Government of the country, acting for the interests of the public, was a principle for which I contended several years ago, when closely connected with that branch of public works. I may venture, without arrogance to say, that if that principle had been then more fully recognised, the proprietors of railway property in England, and the suffering public, would have been in a better condition now than they appear to be.

The principle is a sound one, and I therefore propose to uphold it in the formation of the several lines of railway in India, in the same form in which it has been introduced, and acted upon in the operations of the East Indian Railway Company, in the Presidency of Bengal.

77. It has been objected to the system actually in existence, that by guaranteeing the payment of a fixed interest upon the capital expended, all inducement to economy and exertion upon the part of the Railway Company is destroyed, and that by admitting the direct interference of Government, the Railway Company is obstructed and delayed.

These objections do not appear to be well founded.

It is to be presumed that interest will not be guaranteed by the Honourable Court upon any sum to be expended until it has satisfied itself that this sum which it is proposed to raise for the construction of any fixed extent of railway is not more than is sufficient for the work well and economically carried on, or without some secure provision for the completion of the line within a period to be named. If these conditions be observed, I apprehend it cannot be correctly said that all inducement to economy and exertion is lost. These will be requisite to enable the Railway Company to construct the line within the sum and the time allotted for it. Nor will inducements to the utmost economy and exertion ever be wanting, unless it be supposed that the company would be wholly indif-

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ferent to any prospect of gaining a higher return upon their capital than the rate of interest guaranteed, which an economical construction and working of the line might probably enable them to realise.

78. On the other hand, it does not necessarily follow that because the Government has become a party to the undertaking, by guaranteeing a certain interest upon the capital expended, and has thus gained a right to closer interference with the operation of the Railway Company than usually or properly is allowed to a government, that it will therefore interfere vexatiously or obstructively. It is not difficult to conceive that the Government, by its officers, may exercise a close and vigilant check upon the proceedings of the company, without giving any just cause of complaint.

Experience of the working of this system in the Presidency of Bengal justifies the opinion I have expressed. The consulting engineer is placed in direct communication with the Railway Company, and has authority to settle all matters of detail, or professional questions, unless they should be of great magnitude, without previous reference to the Government. Every precaution is taken to obviate delay in those cases in which the action of the Governor-general in Council is needed. I have every reason to believe that these measures have been successful; and that while the consulting engineer directly and indirectly exercises upon behalf of the Government a very wholesome control indeed over the proceedings of the Railway Company, neither obstruction, nor vexation, nor delay, can be justly attributed to the existence of a power of control in the hands of the Government.

79. Having advised the Honourable Court to entrust to private companies, under the control of Government, the construction of the lines of railway at present required for India, I have to submit the opinion that has been called for on the general principles of action regarding railways proposed in the memorandum before me for the adoption of the Government of India. They are as follows:

" 1st. That all railways constructed in India shall belong to one of two classes. The first or the second class.

" 2d. That the regulating gradient of the first class or trunk railway shall not exceed 1 in 2,000. By regulating gradient, is meant the gradient which regulates the load of the engine.

" 3d. That no regulating gradient of any second class or branch railway shall exceed 1 in 330.

" 4th. That short alternate impulsive planes may be introduced to assist the ascent, not to exceed a length of half a furlong each, and not to be nearer to each other than one and a half furlongs.

" 5th. That no line shall be undertaken when the estimated cost shall exceed the average rate of 5,000 *l.* per mile of single road; but that this rate of cost is not to include the bridging of large rivers, as the Soane, Jumna, &c., exceeding half a mile wide at flood level. Such rivers are to be considered as breaks or temporary termini, where goods and passengers are to be carried across in rafts.

" 6th. That no line shall be sanctioned, except for a single track of rails, with masonry. Cuttings and embankments to correspond. The ground, however, required for a double track to be in all cases secured.

" 7th. That no locomotive engine shall be introduced to India for 10 years, except such as the ratio between the length of stroke of piston and the diameter of the driver-wheels shall sanction with reference to the maximum load, notwithstanding any sacrifice of velocity on the journey. (Rule, No. 11 contains an exception from this restriction.)

" 8th. That when piling for foundations be requisite, the foundations are to be laid in to suit a double track, although the superstructure is only carried up for a single track.

" 9th. That no portion of any line shall be permitted to open for the transport of goods or passengers until the capital account for the construction of such portion shall have been closed.

" 10th. That no more than one train daily shall run in each direction upon any line, until the traffic shall furnish more goods and passengers than one engine can convey. After which, a second may start daily each way; and that when the traffic calls for three trains fully loaded daily, then arrangements shall be made for laying down a second track of rails.

" 11th. That, notwithstanding the tenor of Rule No. 6, if in any line it shall appear that the profits exceed a dividend of 6 per cent. per annum, it shall then be permitted, if thought advisable by the directors of the company interested, to introduce engines of higher powers of velocity, with a view of running passenger trains separate from goods trains."

80. In the first, second, and third Rules, it is proposed that all railways in India shall belong to one of two classes. That the gradient of trunk railways shall not exceed 1 in 2,000, and that the gradient of branch lines, or second-class lines, shall not exceed 1 in 330.

Upon a professional question of this nature I naturally feel some diffidence in giving an opinion contrary to that of an engineer officer of ability and practical experience. Nevertheless, having carefully examined this point, and informed myself through others very capable of informing me upon facts, I have come to the conclusion that I cannot advise the Honourable Court to adopt these three rules in the broad terms in which they stand.

81. In the general principle they are intended to assert I entirely concur. That the engineer by whom a railway may be constructed in India should give his first attention to obtaining such favourable gradients as will leave the greatest possible amount of tractive power in the engine available for moving its load of traffic along the line, and thus secure the utmost profit on its working, no one will deny, and it may as readily be admitted that the engineer in many parts of India will be able to obtain such favourable gradient much more cheaply and easily than could be done in England.

That it is expedient in India to submit lines of easy gradients, though somewhat less direct, in preference to direct lines, where the gradients are adverse, may be fully conceded. Major Kennedy correctly states that I have already publicly recognised this principle in regard to Indian railways, by condemning the bill line to Mirzapore, and adopting the alternative line which he suggested to the Government. In so doing I gave effect to opinions formed and expressed by me in 1848, within a few months after my arrival, and while the railway was still at a stand-still. I think the decision was a sound and good one, upon the ground on which it is put, though it was recommended by other considerations also; and I am quite of opinion that a similar attention to gradients ought to enter largely into the direction of the lines that are hereafter to be constructed.

82. But I am not prepared to assent to the rules while they require an inflexible adherence to this principle carried to an extreme degree. A line constructed at 1 in 2,000 will of course be more cheaply worked than a line with unfavourable gradients, and if the former can be obtained without great increase of extent of line, or vast expenditure of money, every effort should be made to obtain it. But I humbly conceive that it would not be difficult to show that there are but very few cases in India in which such a gradient as 1 in 2,000 could be obtained without such an excessive increase of length of line, or such heavy outlay of capital, as would make it more profitable to work the line with comparatively adverse gradient, however undesirable that course may be in theory.

83. I have further to observe, that the gradients here laid down as indispensable for trunk lines, is practically unattainable as a general gradient for India. The Honourable Court will perceive the opinions of the consulting engineers of Bengal and Madras, to whom I referred this point. Major Pears distinctly states, "the word trunk is, in common language, generally applied to those roads or lines of railway which lie in the direction of greatest traffic and importance. No trunk line so understood could be constructed within the Madras Presidency with such a ruling gradient as this, unless by increasing the line to an extravagant extent. In many cases even this would fail to obtain it." I believe that the same statement would be correct if applied to the Presidency of Bombay.

Bombay. It will be seen also that in this Presidency, and even in the valley of the Ganges, the surveys that have now been made hold out no prospect of a gradient of one in two thousand being attainable in practice. The consulting engineer names a gradient less favourable by half, namely, one in one thousand, as being the best that is practically available upon that line. If a better gradient should be sought, it can be got only by following closely the course of the stream through all its sinuosities, a measure which could not be adopted without exposing the line to the objection that it would be immediately increased in extent, and would be brought, moreover, within the influence of the river to a degree which would be dangerous to its existence. In the face of these facts and opinions I cannot recommend to the Honourable Court to adopt entirely the rules, that no trunk-line should have a worse ruling gradient than one in two thousand, and no branch line worse than one in three hundred and thirty. The principle of easy gradients is, I think, sound, and ought to be enforced in Indian railways. Its observance should be circulated by the Honourable Court, whose officers should be enjoined to pay vigilant attention to it in connexion with the plans of railway companies. But I think it will be better that the Honourable Court should restrict itself to laying down the principle that in every railway the closest attention should be paid to obtain the gradient which will admit of the most profitable working (in fact, that the best should be made of each case), than that it should attempt vainly to insist upon the particular gradients that have been suggested for its adoption.

84. The Rules, numbered 4, 7, and 11, which relate to the introduction of alternate impulsive planes, and to the size of the engines to be employed, are purely engineering questions on which I cannot undertake to give an opinion, and on which the Honourable Court has the means of obtaining authoritative judgment in England.

85. Rule No. 5, which lays down that no line shall be undertaken in India, of which the estimated cost shall exceed the average rate of 5,000 *l.* per mile of single road, will be governed, I think, by the same considerations as those which were applied to the rules regarding gradients.

The importance of a cheap construction of the works to the success of an undertaking is obvious. There is every reason to believe that in India the cost of railway per mile will probably, on the average, be less than the cheapest of the lines constructed in England, and it is very expedient to lay down such principles as are involved in Rule 5, and explicitly stated in Rules 6 and 8, in order to ensure that railway engineers shall consult the utmost economy in their works consistent with security and efficiency, and shall swell the cost neither by useless ornament nor by superfluous solidity.

I entirely concur, therefore, in the recommendation that all lines shall be formed for a single track of rails, with masonry, cuttings and embankments to correspond, excepting only in the case of piling or difficult foundations, which shall be formed at once to suit a double track, and in all cases being taken for a double line.

In like manner all buildings, stations, and appliances of every kind should be built only for use, and all heavy expenditure upon architectural decoration should be rigidly proscribed.

86. But I am not prepared to advise that 5,000 *l.* should be fixed as the highest average rate of cost per mile that shall be admissible. The Honourable Court and this Government, and the railway engineers themselves, have not yet acquired sufficient experience in the formation of railways in India to enable them to specify with exactness what ought to be the average cost of construction.

In Madras the consulting engineer estimates the short line in preparation there at less than 5,000 *l.* per mile, but experience has not yet tested the accuracy of his estimate in any respect.

In Bengal some experience has been obtained.

The first section, of 120 miles, it may now be calculated will not exceed 7,500 *l.* per mile, and this section includes the main terminus and works at Calcutta.

The next section, of 120 miles, from Runderoh to Rajmahal, is estimated to cost about 8,500 *l.* per mile.

The section of 440 miles, from Rajmahl, at Allahabad, which has just been surveyed, is estimated at about 8,700*l.* per mile.

Although the plain of Bengal is flat, and so far favourable to railway works, it is crossed by numerous rivers, and liable annually to heavy inundations, which tend greatly to increase the cost of construction, and the estimates I have quoted above include the expense of bridging all the rivers (except the Soane and the Jumna), many of which are of great size during the rainy season. Still, after making allowance for these considerations, and having regard to the statement of Mr. Stephenson, that his estimates are avowedly made high in order to be on the safe side, it does not appear probable, according to our present experience, that we can rely with certainty on constructing an ordinary mile of road for 5,000*l.*

Para. 11.

Upon this point, Major Baker has stated it as his opinion, that this sum cannot, as yet, be safely fixed as the average rate. He says, "I believe that a single line, not involving expensive river crossings, or other special heavy works, ought to be constructed for 5,000*l.* per mile, but justifiable exceptions will occasionally arise, and should not be entirely precluded."

Under these circumstances I would advise, that while the principle of economical construction should be jealously insisted upon, and an approximation to the sum of 5,000*l.* per mile of ordinary way should be aimed at, no specific sum should be fixed by the Honourable Court as the highest average rate of cost per mile for railways throughout India.

87. The 9th rule, which declares that no portion of any line shall be permitted to open until the capital account for the construction of such portion has been closed, may advantageously be adopted on principle, but modified in its stringency, so as to bring it into accordance with the practice sanctioned by the Honourable Court in 1849.

88. The Rule No. 10, which limits the running of trains to one and two on each day, under certain specified circumstances, appears to me to be a matter of detail which had better not be introduced as universally applicable to every future line.

89. It only now remains that I should submit to the Honourable Court, in obedience to its instructions, my opinion whether railway works in India should be carried on simultaneously, and by what companies they should be undertaken.

I have no hesitation in recommending, in the strongest terms, that the several trunk lines throughout India which have now been suggested, and especially the great line from Calcutta to the north-west frontier, should be completed as speedily as may be practicable; and to that end that the several portions of the works should be commenced and carried on simultaneously.

90. In reply to the question whether it will be advisable that the Honourable Court should enter into several distinct contracts with different companies of British capitalists, I would submit that it is not advisable that too large an extent of railway should be placed in the hands of any one company, while at the same time economy and public convenience are undoubtedly promoted by as close an approach to uniformity of management as may be consistent with the exercise of a vigilant and effective control over the entire line.

91. The Honourable Court has already sanctioned the establishment of the East Indian Railway Company, in the Presidency of Bengal. It is constructing 120 miles of line, has obtained a concession of the extension of 120 miles further to Rajmahl, and now applies by its managing director, Mr. Stephenson, for permission to execute the line which it has surveyed onwards to Allahabad, and ultimately to construct a line to Delhi; with, if it is wished, an extension to Lahore and a junction with Bombay, by way of the Soane Valley. It undertakes to execute completely these lines within seven years, or before the close of the year 1860.

A memorial has been addressed to the Governor-general in Council, by Mr. H. Borradaile, on the part of a company styled the Upper India Company; and subsequently letters have been received from the chairman of the company, and from its solicitors, in which they state that the company has proposed to the Honourable Court to construct a line from Allahabad to Agra and Delhi.

92. The

92. The East Indian Railway Company has had a difficult task to perform. It entered on an entirely novel undertaking, and, as might have been expected, has had much to contend with. It is therefore entitled to some consideration in the judgment that may be formed on its first operations.

Although I am inclined to believe that more rapid progress might have been made in the execution of the works that have been in hand during the last two years, I am not disposed to condemn the proceedings of the company.

Mr. Stephenson, in his recent report, has stated that "the first section will be completed by the latter part of next year (1854), portions of it being opened, and locomotives, with carrying stock, provided and placed upon the line within the next few months."

This section of 120, equal in extent to the Great Western, and exceeding the London and Birmingham, will be opened, if Mr. Stephenson's anticipations be fulfilled, in about four years from its commencement. People in this country, accustomed to deal with great distances, are disposed to think lightly of four years being required for what seems to them so small a length of line. For my own part, adverting to the fact that this has been a first attempt, and that the works upon the line are considerable, though the country over which it is carried is level, I am not prepared to say that further confidence should be withheld from this company.

It has already received the sanction of the Honourable Court to extend its line to Rajmahl. It declares itself ready and anxious to continue the line to Allahabad. No other company has appeared to compete with it for this portion of the trunk line. If there had been any, I should still have recommended, as I have now the honour to do, that the East Indian Railway Company should be permitted to undertake the construction of the line from Calcutta to Allahabad, carrying it on in different portions simultaneously and with all practicable speed.

93. It would not be expedient to admit a second management within so manageable a length of line as that between Calcutta and Allahabad.

Moreover, it is for the interest of the Honourable Court to concede the whole of this distance to the same company. The Honourable Court has guaranteed to the East Indian Railway Company 5 per cent. on the first section to the Collieries, and 4½ per cent. on the second section to Rajmahl. It will greatly diminish the risk and liability of the Honourable Court, if its concession to the East Indian Railway Company include the upper and profitable portion of the line as well as the lower, which appears likely to be less profitable.

For this purpose, and in order to avoid the inconvenience which certainly will result from different rates of interest being guaranteed upon the capital employed in the construction of different portions of the same line, I would suggest that the agreement to be formed with the East Indian Railway Company shall guarantee one rate of interest upon the whole capital employed.

94. The Honourable Court has quoted an opinion I expressed two years ago, that future bargains with railway companies in India might be made on easier terms than they had hitherto been. Everything that has since occurred goes to confirm the opinion which I took the liberty of expressing, and still hold. The East Indian Railway Company has itself undertaken the extension to Rajmahl at the lower guarantee of 4½ per cent. The Baroda and Central India Company, in their memorial, ask only for 3½ per cent.; and the Upper India Company offer to make their proposed line on terms more moderate than those hitherto granted.

These offers actually made, taken in connexion with the present abundance of money, justify me in expressing a confident expectation, that the East India Railway Company will be glad to undertake the line to Allahabad on more favourable terms than those they have previously accepted, and as favourable as any that will be offered by any other company.

It would be expedient that, if possible, the company should be bound to complete the line to Allahabad within a period of time to be named, under the penalty of a reduction of the guaranteed interest by a certain proportion for every half year by which the railway company delays the completion of its work beyond the period named.

95. In recommending these conditions, I beg leave to advise that the terms to be granted should be liberal both in respect of money and time.

96. It is more difficult to advise the Honourable Court upon the course which it will be best for the public interest to pursue above Allahabad.

I am not at all disposed to undervalue the benefit of competition, and I would therefore by no means exclude the Upper India Company from making specific proposals for the line, which the papers before me do not show them to have done.

If that company should be allowed to form their line, Allahabad will probably not prove an inconvenient break, while Delhi would be an equally eligible point for all companies. And I assume, as a matter of course, that the Upper India Company would be subjected to the same control in the hands of the Government as the existing company.

On the other hand, I do not conceive that the substantive line from Calcutta to Delhi would be more than a single management could safely and effectively control; and that being so, there would undoubtedly be great convenience and advantage, both to the Honourable Court and to the public, as well as considerable economy, in one uniform management extending over the whole of this great trunk line.

The East Indian Railway Company has already acquired some experience; its managing director, Mr. Stephenson, has knowledge and practice in Indian railway affairs; and these circumstances would entitle us to expect from them a speedier execution of the work than from parties entirely new to the country and the people.

97. The Honourable Court too may possibly feel that those who have been the pioneers of railway enterprise in India are entitled to be received with some favour when competing for the privilege to extend the works they have commenced over other districts directly connected with that on which they first began, under the directions of the Honourable Court.

These considerations would not induce me to recommend that the East Indian Railway Company should be permitted to make the entire line from Calcutta to Delhi on a monopoly footing, or without giving other parties already in the field a right of bidding for the preference.

But if the East Indian Railway Company should offer to construct the line onwards from Allahabad to Delhi on terms as favourable, or even nearly as favourable as its competitor, the Upper India Company, I conceive that the public interests would be served by the line being allotted to the East Indian Railway Company, and I would advise the Honourable Court to grant it accordingly.

98. The capital which it would be necessary for the company to raise in order to the execution of these works would be very large. The great companies existing in England, however, have raised capital as large; and I am not aware of any reason why one formed for similar purposes in India should not be invested with the same power, or be able to use it successfully.

In these remarks, I assume of course the sufficiency and stability of the railway company, matter of which we can have no knowledge here, but of which the Honourable Court of Directors has the ready means of satisfying itself.

99. Before concluding this Minute, it may be convenient to recapitulate the recommendations regarding railways in India, which I beg to offer to the Honourable Court:—

1st. That a general system of railways connecting the several Presidencies, and constituting the great trunk lines within them, should be sanctioned and executed without further delay.

2d. That the trunk line in the Presidency of Bengal should be carried up the Valley of the Ganges to Allahabad, and thence up the Doab to Agra and Delhi, with a view to its being extended through the Punjab westward as soon as its construction may be found practicable, and that the line to Diamond Harbour should be rejected.

3d. That a junction line should be formed between the above-mentioned trunk line and the Presidency of Bombay, either by the Valley of the Nerbudda or by way of Baroda and Neemuch, but preferably by the latter in the first instance, if further examination should recommend it.

4th. That

4th. That in Bombay the Malsej Ghaut lines should be abandoned.

That the Thull Ghaut line should not be sanctioned as a great trunk line of communication between Bombay and other parts of India.

That a line to Candesh and a line to Poona should both be undertaken.

That if one only can be chosen the line to Candesh should be preferred.

That it should not be resolved to carry such line to Candesh up the Ghauts, unless a survey of a line by the Taptee River should show the Ghaut line to be less objectionable than the river line.

That if the Ghaut line should prove the better, it should not be sanctioned, as now proposed, by the Thull Ghaut, unless further survey shall establish that no better access to the table land can be found on the Syhadree range, and that the present objectionable features in the Thull Ghaut line cannot be avoided.

Lastly. That the same rule should be applied to the line by the Bhor Ghaut.

5th. That a line should be formed in the Presidency of Madras by Meul (to which point it has already been sanctioned), by Vellor, Vaniembuddy, Coimbatore, and thence to the Western Coast, with a branch to Bangalore, and a branch also to the foot of the hills towards Ootacamund.

That another line should be constructed in the Presidency of Madras, from that city, by Cuddapah to Bellary, and that surveys, &c., should be made with a view to its extension across the table land to Poona, in the Presidency of Bombay, in order thereby to form a junction with the Western Coast.

6th. That the construction of these lines should be committed to incorporated railway companies, under the control of the Government, in the manner in which it has been agreed upon with the East Indian Railway Company, and on such terms as may be fixed.

7th. That if it be necessary to guarantee a certain interest on the capital of the company, means should be taken to ascertain approximately the probable amount required for the construction of the line, and that the amount of requisite capital on which interest is to be guaranteed should be strictly defined, and that the completion of the line should be required within a certain fixed period, under the penalty of a diminution of a certain proportion of the guaranteed interest for every half-year in which the line shall remain incomplete after the expiry of the period fixed.

8th. That all lines for the present shall be formed with a single track, with bridges, embankments, &c., for the same, land being in all cases taken, and the foundations of extensive works laid to suit a double track.

9th. That the officers of the Honourable Company should be required to exact the utmost economy consistent with perfect security and efficiency in the original construction of the line, and in all buildings and works of every description connected with it.

10th. That no portion of a line should be opened for traffic until the capital account for that portion of the line shall have been closed, in such manner as shall be to the satisfaction of the Government of India.

11th. That the line, when opened for the conveyance of passengers and goods, shall, in like manner, be managed with the closest attention to economy in the working expenses, rather than with a regard to the high rate of speed and frequency of despatch which are the practice on the English lines.

12th. That the construction of lines to be managed upon the foregoing principles should be conceded to the East Indian Railway Company, from Calcutta to Allahabad, one uniform rate of interest being guaranteed upon the capital required for the whole line, if a guarantee be indispensable.

13th. That the construction of the line from Allahabad to Delhi should be granted to the East Indian Railway Company, or to the Upper India Company, but preferably to the former, if it will undertake the works on terms as favourable, or nearly as favourable, as those offered by the latter company.

100. I have the honour respectfully to submit these several recommendations to the Honourable Court of Directors, and to express my earnest hope that it will resolve at once to engage in the introduction of a system of railways into the Indian empire upon a scale commensurate with the magnitude of the interests

that are involved, and with the vast and various benefits, political, commercial, and social, which that great measure of public improvement would unquestionably produce.

(signed) *Dalhousie.*

MINUTE by the Honourable Sir *F. Currie*, Bart., dated the 2d May 1853.

THESE very voluminous papers came to me on Friday. I have studied with great attention the Governor-General's Minute, and I have given the best consideration which I am able, under the pressure of preparation for departure from India in a few days, to the immeasurably important subjects discussed therein, many of which have necessarily been for some time familiar to me, and have been, more or less, subjects of thought and deliberation. I entirely concur with the Most Noble the Governor-General in his opinions regarding the vast importance of Railways in India, in every point of view, and regarding the lines which should be first attempted in the several Presidencies, and the means by which these comprehensive operations should be carried on.

(signed) *F. Currie.*

MINUTE by the Honourable *J. Lewis*, dated 2d May 1853.

RAILWAYS.

I FULLY concur in the views of the Most Noble the Governor-General on this most important subject, and in the earnest hope expressed by his Lordship that a system for the introduction of Railways over the whole Indian Empire may be at once organised.

The more specific recommendations contained in his Lordship's Minute appear to me to be highly practical and judicious, and calculated to secure the great end in view economically and within a reasonable time.

In my opinion there is nothing which will give so immediate an impulse to the moral, social, and commercial improvement of this country as these Railways.

(signed) *J. Lewis.*

RAILWAYS (INDIA).

COPIES or EXTRACTS of CORRESPONDENCE
received by the last Mail from the Governor-
General in Council in *India*, relative to RAILWAY
UNDERTAKINGS in that Country.

(*Sir Herbert Maddock.*)

Ordered, by The House of Commons, to be Printed,
19 July 1853.

[*Price 1 s. 6 d.*]

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